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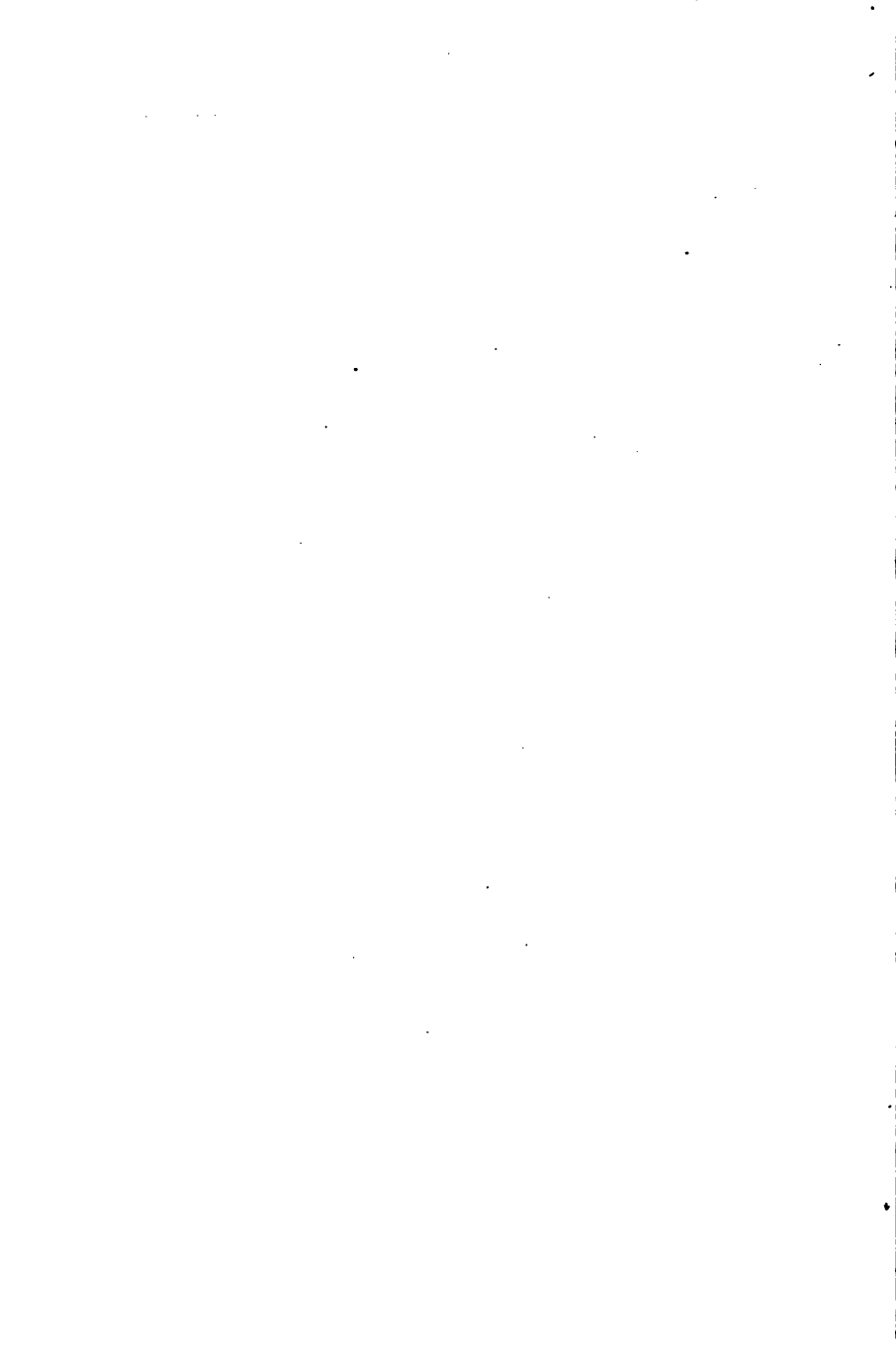
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SOME BIRDS OF PREY.

Lesson 2.

0

CHATTY READINGS IN
ELEMENTARY SCIENCE

BOOK III
NATURE KNOWLEDGE



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CHATTY READINGS IN ELEMENTARY SCIENCE

BOOK III

LESSON 1.

MANLIKE ANIMALS.

doubt'-less	in-tel'-li-gence	an'-tics	up-right'
read'-i-ly	im'-it-ate	knuck'-le	dif'-fer-ence
ex-am'-ined	un-gain'-ly	bab-oons'	serv'-ice
per'-fect-ly	awk'-ward	in'-tel-lect	wit'-ness

1. If you were asked which animal most resembles a man, you would doubtless name the monkey.

2. Still great and marked differences are readily seen when they are examined side by side.

3. A man stands perfectly upright upon two feet, and his face bears witness to his intellect. There is no kind of monkey which can stand quite upright, nor does the face of any of them ever show much intelligence; the forehead is always too low to leave much room for brain power.

4. Why does a monkey always look so ungainly

when it tries to imitate the walk and movements of a man? It is because the monkey is formed to



spend its life among the branches of a tree, and not upon the ground.

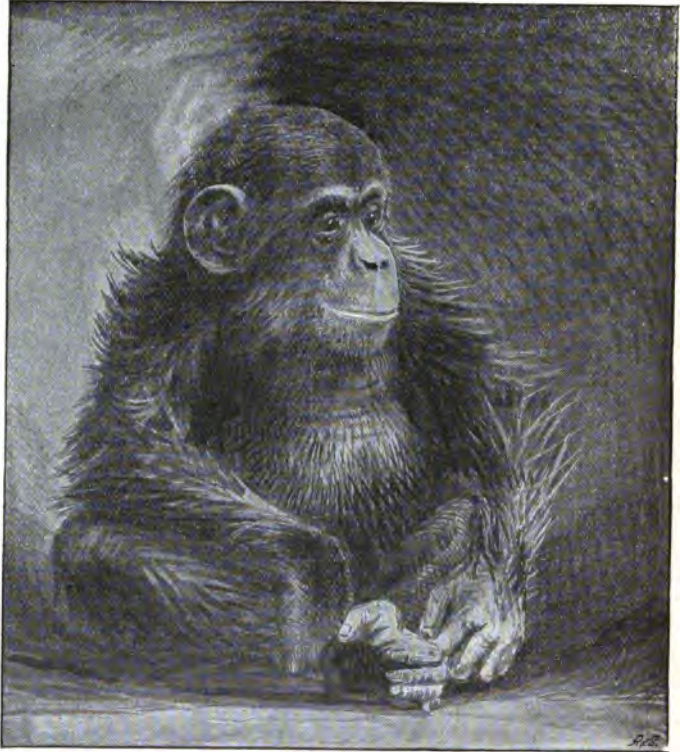
5. We should be just as awkward if we tried

to copy the antics of a monkey up a tree. When we climb do we not find our hands of more service



to us than our feet? A monkey has four hands and no feet — hence his great climbing powers.

6. An ape is a kind of monkey which has no tail. Apes are about the size of a man and are often large and powerful. Their arms are very



A BABOON (CHIMPANZEE).

long; when standing quite upright they are able to rest the back of the hand upon the ground. For this reason they are called knuckle-walkers.

7. The baboon is a monkey with a short tail, and a head somewhat like that of a dog. It usually goes upon all fours. Baboons have cheek pouches, which they use as pockets for storing nuts or other food. They are fierce and sullen, and not at all playful like real monkeys.

8. The real monkeys have long tails, and seldom attempt an upright position. They are therefore less like men than apes or baboons. Some of them use their tails as a sort of fifth hand; for they can grasp with it, and swing head downwards from the branch of a tree. The tip has a sense of touch almost as fine as that of our fingers.

9. Monkeys are found in both the New and Old World. They inhabit hot countries, especially South America, Africa, and some parts of Asia. One species called the Barbary ape is found upon the rock of Gibraltar, in Spain. This is the only European monkey.



LESSON 2.

SIGNS OF RAIN.

ha'-los	snort'-ing	nim'-bly	il-lumed'
bod'-ing	whisk'-ered	jaunt	whirl'-ing
pim'-per-nel	pre-cip'-it-ate	ed'-dy	pierce'-ing

1. The hollow winds begin to blow,
The clouds look black, the glass is low,
The soot falls down, the spaniels sleep,
The spiders from their cobwebs peep.
Last night the sun went pale to bed,
The moon in halos hid her head;
The boding shepherd heaves a sigh,
For, see, a rainbow spans the sky.
The walls are damp, the ditches smell,
Closed is the pink-eyed pimpernel.
2. Hark, how the chairs and tables crack !
Old Betty's joints are on the rack ;
Loud quack the ducks, the peacocks cry,
The distant hills are seeming nigh.
How restless are the snorting swine !
The busy flies disturb the kine ;
Low o'er the grass the swallow wings !
The cricket too, how sharp he sings !
Puss on the hearth, with velvet paws,
Sits wiping o'er her whiskered jaws.

3. Through the clear stream the fishes rise,
And nimbly catch the incautious flies.
The glow-worms, numerous and bright,
Illumed the dewy dell last night.
At dusk the squalid toad was seen
Hopping and crawling o'er the green;
The whirling wind the dust obeys,
And in the rapid eddy plays;
The frog has changed his yellow vest,
And in a russet coat is dressed.
4. Though June, the air is cold and still,
The mellow blackbird's voice is shrill.
My dog, so altered is his taste,
Quits mutton bones on grass to feast;
And see yon rooks, how odd their flight!
They imitate the gliding kite,
And seem precipitate to fall,
As if they felt the piercing ball.
'Twill surely rain, I see with sorrow;
Our jaunt must be put off to-morrow.

JENNER.



LESSON V.

THE DAILY ELEPHANT.

thin-skinned	por-cer-ous	start-ling
hip-po-pot-a-mus	i-vo-ry	en-cour-aging
quad-ruped	en-clos-ure	has-frat-ed
do-ile	dis-sat-is-fied	im-pa-tient-ly
ob-e-dient	mus-cle	fright-ened

1. Our most useful working animal is the horse. The horse, the ass and the pig belong to the thick-skinned animals. In the hot regions of the earth the thick-skinned animals are represented by the elephant, the hippopotamus and the rhinoceros. All of them have very tough, thick skins and hoofs feet.

2. In hot countries the elephant is of great use to man. It is the largest of all quadrupeds. As a beast of burden, it is about eight times as strong as a horse. Notwithstanding its immense size and strength, it is easily tamed, and becomes docile, obedient and faithful, so long as it is kindly treated.

3. The trunk of an elephant is only its nose or snout grown exceedingly long. From the nostrils a double tube runs up the entire length of the trunk. It is interlaced with thousands of muscles, by which it is readily moved in every direction.



AN ELEPHANT AT WORK.



At the end is a finger-like point. With its trunk the elephant can pick up a thing as small as a pin, or as large as a beam of wood.

4. As the elephant's large head is joined to its ponderous body by so short a neck, the trunk becomes necessary to it as a feeler for reaching out. On each side of the trunk a large tusk of ivory points downwards from the upper jaw.

5. The eyes are small, and the ears large and flapping. The legs are clumsy and shapeless, but solid looking, as they must be to carry the weight of a body so bulky. The huge feet are slightly divided into five rounded hoofs. The skin is naked except for a few bristles.

6. Wild elephants live in the woods, feeding on the leaves, fruits, grains and grasses of the forest. Hunters make a strong enclosure, into which they drive the wild elephants, using tame ones to assist them in



AN ELEPHANT'S FOOT.

the hunt. After a wild elephant has been caught, and tied up without food for several days, it begins to submit quietly to its training.

7. Many anecdotes are told of the intelligence,

fidelity and affection of this noble animal. Though a willing worker, the elephant is so fond of working in his own way, that a great writer on life in India has called him "my lord the elephant." For instance, the elephant would rather push the heaviest wagon with its head than drag a lighter one with chains. The lordly elephant dislikes to be put in harness like the more humble-minded horse.

8. An elephant was once at work without an attendant to look after him. He was snorting "Urmph!" to himself in a dissatisfied tone of voice; for he had to carry a heavy beam of timber along a narrow pathway in the forest, and was forced to turn his head first to one side and then to the other, in order to get his load past the trees.

9. A gentleman rode up and found him laboring thus painfully. On seeing the rider, the elephant put down his burden and forced himself backward among the underwood to allow the horse to pass. The horse, however, was frightened and hesitated. The elephant, observing his fear, impatiently thrust himself farther back with another "Urmph!"

10. Still the horse paused and trembled. After another backward push, and an encouraging "Urmph!" from the elephant, the timid horse was at last induced to pass. Then the wise ele-

phant picked up his load again, and went on with his work, but still grumbling to himself as before.

LESSON 4.

INTERESTING SOLE-WALKERS.

ex'-er-cise	for'-mid-a-ble	noc-tur'-nal	bi'-ped
mis'-er-a-ble	prom'-i-nent	dif'-fi-cult	be-hind'
shuf'-fling	of-fen'-sive	sep'-ar-ate-ly	en-a'-bles
haunch'-es	re-pul'-sive	ob-scure'	de-lib'-er-ate
squeez'-es	ma-raud'-er	weap'-ons	po-si'-tion

1. Have you ever tried to walk for some distance on tip-toes? And while you were walking



A BLACK BEAR.

with your heels in the air did you not soon feel tired of the exercise, and in constant danger of tumbling over?

2. Yet most of the creatures we see around us are toe-walkers. If you look at the foot of a cow, or of a dog, you will notice that the heel is lifted up behind, and that the animal really walks upon its toes. Man is a biped—that is, a two-footed animal—and no doubt needs to walk on the flat of the whole foot, from toe to heel, in order to secure a firm tread.

3. We shall find that there are a few quadrupeds, or four-footed creatures, which, like man, are also sole-walkers. The bear is a sole-walker. The walk of a bear is awkward and shuffling; he brings not only the toes, but the whole of the under surface of the foot, into contact with the ground at every step.

4. This formation of the hind feet enables a bear to sit up on its haunches, and to use its forepaws for holding its food or for striking a blow. A bear can walk on its hind legs, while a dog finds it difficult even to sit up on its hind toes.

5. A bear, in this upright position, can stand firmly against attack. Should an enemy come within reach, Bruin will hug him with an embrace which either squeezes out the life, or enables the bear to rend in pieces the unhappy victim with his teeth.

6. The claws of a bear are not only formidable weapons, but the beast has the power of moving

each claw separately, as we move our fingers. A bear is able to overcome and carry off a heavy beast, and then to dig a pit large enough to bury it in.

7. Another very interesting sole-walker is found in this country.

Common to most localities, he is more familiar by name than by habit or worth, and is usually looked upon as an outcast or miser-



BEAR'S FEET, SHOWING CLAWS.

able marauder. Still he has his place and does his special work. This repulsive but helpful animal is the skunk.

8. He belongs to the weasel family, though no sleek-skinned weasel cares to call the skunk cousin. The skunk's main defense is a fluid of most disagreeable odor. So sickening and offensive is the smell that people and animals alike avoid him. For this reason few know his value. His unpleasant traits are so prominent that they almost obscure his usefulness and worth.

9. He is about the size of a cat, the head is small, the nose pointed, and the forelegs are short and armed with long claws for digging. He wears

a black, long-haired coat ; often there are broad white stripes upon the sides, while the crown and forehead are white. The tail is large and bushy. His movements are awkward and deliberate.

10. Nocturnal in habit, a moonlight night is his delight. He feeds upon meadow mice, salamanders.



THE SKUNK.

grasshoppers, caterpillars, destructive beetles and grubs. He is a true field-scavenger, destroying by night the wasters of crops and herbage. The fur is valuable ; it is known in trade as Alaska sable. Poor despised skunk, he is lonely and outcast

necessarily ! One wishes he might not be trapped and destroyed, but allowed to do his work about the fields and meadows.

LESSON 5.

AMERICAN BEARS.

in-hab'-it-ant	veg'-e-ta-bles	con-sid'-ered
wil'-der-ness	car-niv'-o-rous	del'-i-ca-cy
men-ag'-er-ie	cum'-ber-some	es-pe'-cial-ly
ri-dic'-u-lous	con-di'-tion	clas'-si-fied
en-raged'	a-gree'-a-ble	suf-fi'-cient

1. The grizzly bear seen in the picture is the largest, strongest and most dangerous of all bears. When hungry it will sometimes chase a man. Grizzly bears are found in the Rocky Mountains.

2. They are very cunning and unsociable. Their dens or lairs are in the denser forests and the mountain caves. The family generally consists of the male and female bears and their two cubs. Hunters kill them for their fur and meat. They sometimes smoke them out of their dens and then shoot them.

3. The black bear is more common. He is an inhabitant of the wildernesses of the eastern and central states. We meet him at the menagerie and find him there a playful and ridiculous fellow. Still he is capable of great rage and fierceness. At



A GRIZZLY BEAR.

home in the wilderness he reigns as king, but he seldom attacks a man unless driven by hunger to do so.

4. Bears are very fond of honey. Wild bees store it in hollow trees. Bruin knows this and does not hesitate to turn robber and enjoy a feast at the bees' expense.

5. A bear's fur is exceedingly thick and affords sufficient protection against the enraged bees. As they light thickly upon him to sting and drive him away, he retires from the scene to roll upon the ground and crush the bees. Then he returns for another course of sweets from the bees' well-stored larder.

6. These bears are not only sole-walkers, but they are animals of a mixed diet. Their food consists of flesh, poultry, vegetables, fruits, berries, beech-nuts, roots, ants and their eggs, and honey. Because of this mixed diet bears are classified at the end of the flesh-eaters, so as to come just before the grass-eaters.

7. Unlike the grizzly or black bear, the polar bear eats only flesh and fish. Such food as fruits and vegetables would not be adapted to the extreme cold of his home. He lives in the dreary Arctic regions among the fields of ice and snow. Because he eats only flesh and fish, he is said to be carnivorous. The soles of his feet are covered with short

hairs to prevent him from slipping upon the ice. His fur is long and white.

8. Bears grow very fat during the summer and autumn. In the winter they hide in some cave and curl themselves up to sleep through the cold months. It is perhaps not so much the severity of the weather as the scarcity of food that prompts them to retire for this long nap. Sunny spring days bring them out again, though not the sleek, rounded creatures of the autumn. The long fast has made them lean, and bodies and fur are in poor condition.

9. Though their bodies are heavy and cumbersome, bears are capable of great speed. They like the water and swim with ease for a mile or more.

10. The fur is in its best condition in the early winter, before the food supply becomes scarce. Bear's fur is used for rugs, robes, capes, caps, etc. The flesh is an agreeable food. Bear's steak is a delicacy; the hams and paws are considered especially good.



LESSON 6.

TOPSY-TURVYDOM.

con'ti-nent	do-mes'tic	rel'-ish	grav'-el
mil'-lions	in-tro-duced'	pouched	man'-grove
com'-ers	lei'-sure	rep'-tile	south'-ern
oys'-ters	tooth'-less	hatched	Aus-tral'-ia

1. On the other side of the world is a large island, in fact a whole continent, which is a part of the British Empire. It is called Australia, or the great southern land.

2. About a hundred years ago there were only a few wild men living there, but now there are millions of English people who have made that land their home.

3. It is a fine country, but the settlers found it very strange at first in many ways; so many things seemed topsy-turvy, or the wrong way about. In Australia the sun is in the north at midday. It is winter there when it is summer in America; and it is day there when it is night here.

4. Both the animal life and the plant life of Australia were quite unlike that which the newcomers had been used to in their old home.

5. Most of the birds there had no song, the bees no sting, and the flowers no scent. The trees

were all evergreens, and shed their bark, but not their leaves. The cuckoo there builds her own nest and does not use those of other birds, as she does elsewhere. And the oysters seem to be growing on trees, for they fasten themselves to the shoots of the mangrove tree that grows on the seashore in the water.

6. The settlers found no grain to eat and no domestic animals to give milk, or to work for them. Most of the useful plants and animals had to be introduced from England. The animals were all new, and strange in many ways; among them perhaps the strangest was the duckbill, which seems to be a bird, a beast and a fish all in one.

7. The duckbill lives on the banks of rivers. It is four-legged and covered with fur. It has a broad bill like that of a duck, with which it grubs in the mud for small shellfish. These it cracks with its strong, horny, toothless jaws, and eats with a relish. While hunting, it stores up all it catches in cheek-pouches, like a monkey, and eats afterwards at leisure.

8. It swims and dives with ease, its feet being webbed — the web extending forward even beyond the toes of its fore feet. It burrows like a water-rat, digging holes with bill and claws, even through the hardest gravel. It produces its young from

eggs, and yet the young ones are suckled by the mother.

9. What a strange animal to meet with! A mammal covered with fur, having a bill and laying eggs as a bird does!

10. Some of the birds, too, were found to be



THE DUCKBILL.

almost reptile-like, for they were mound-builders, placing their eggs in mounds of earth, and leaving them there to be hatched by the heat of the sun.

11. But animals of any kind were found to be rather scarce in Australia; and all of them except

some rats, mice and the dingo, or native dog, were found to belong to that group of crea-



THE DINGO.

tures which shelter their young in a pouch. The largest of these pouched animals is called the kangaroo.



LESSON 7.

THE KANGAROO.

high'-er	im-mense'-ly	curved	boom'-er-ang
prin'-ci-pal	at'-ti-tude	val'-ue	in-sen'-si-ble
as-sist'-ing	fash'-ion	ven'-tures	tre-men'-dous
ra-pid'-i-ty	de-cep'-tion	spe'-cies	ap-pear'-ance

1. The kangaroo is the largest animal found in Australia. The great kangaroo measures five feet in length, to which must be added three feet for the tail. A full-grown animal sits up seven feet, that is, a foot higher than a tall man stands.

2. The kangaroo is a gentle-looking creature, with a head like a deer. The female kangaroo carries her young about in a kind of pouch or bag in front of her body. From this pouch the young ones will come out for a little exercise, and they will leap back into it again on the slightest alarm. In this bag the young are nursed until they are sufficiently grown to protect themselves.

3. With many animals that dig and burrow, even the little mole, the power of the body is placed chiefly in the fore legs. In the kangaroo, the principal power is placed in the hinder part of the body. While the fore legs are small and used more as hands than for walking, the hind legs are immensely powerful. The tail also is

thick and strong, assisting the animal not merely to sit up, as on a three-legged stool, but to make tremendous bounding leaps.

4. So rapidly are these leaps made, that the animal appears to light always on its hind legs,



THE KANGAROO.

and not to touch the ground with its fore legs at all. This appearance, however, is a deception, owing to the rapidity with which the leaps are made.

5. The natural walking attitude of the kangaroo is on four legs, although the animal is constantly seen sitting up, tripod fashion, to feed on the tall rich grass, and the tender tops of plants.

6. When attacked or frightened, the kangaroo bounds away with mighty leaps of about twenty feet each. He is not readily caught. The natives kill him by throwing a strangely curved, heavy stick called a boomerang, which at the least will always knock him insensible.

7. The settlers hunt him with dogs. The dogs sometimes get roughly treated if the animal turns to bay; for he can strike a fearful blow with his leg. The creature has five toes on each fore foot, and four on each hind foot; all of them have big strong nails, particularly one on each hind foot. With a weapon like this he can rip open the largest and strongest enemy that ever ventures to attack him.

8. There are many species of kangaroo, the strangest being the tree kangaroo, which can hop about on trees, and has curved claws on its fore paws, to enable it to hold on to the branches.

9. The flesh is sometimes eaten as a kind of venison. The tail of the kangaroo is said to make better soup than that of the ox. The fur is also of some value.

LESSON 8.

THE SPARROW'S NEST.

spar'-rows
yon'-der

med'-ley
sil'-ver-y

threads
en'-e-mies

rub-bish
neat'-ly

1. Nay, only look what I have found !
A sparrow's nest upon the ground ;
A sparrow's nest, as you may see,
Blown out of yonder old elm tree.



THE SPARROW.

2. And what a medley thing it is !
I never saw a nest like this,—
Not neatly wove, with tender
care,
Of silvery moss and shining
hair ;

3. But put together, odds and ends,
Picked up from enemies and friends ;
See, bits of thread and bits of rag,
Just like a little rubbish-bag !

MARY HOWITT.



A SPARROW'S EGG.

LESSON 9.

THE KING OF BIRDS.

tru'-ly	im-pos'-si-ble	ob'-jects	gen'-er-al-ly
ti'-tle	pos'-si-bly	fre'-quent-ly	height
seiz'-ing	fierce'-ly	ae'-rie	clutch'-es
tal'-ons	ad-just'-ed	dan'-ger-ous	vic'-tim

1. The eagle is called the king of birds. Its size, strength, courage and keen sight give it the title, for it has a truly noble appearance.

2. The beak of the eagle is nearly straight for some distance from the base, and then suddenly bends downwards into a sharp hook. It is as sharply pointed as it is boldly curved, and well suited for its work of tearing flesh.



AN EAGLE'S TALONS.

3. The claws, or talons, as they are called in birds of prey, are curved and pointed for seizing the victim, and then holding it tightly. The prey is always caught with the talons, not with the beak.

4. When an eagle strikes a bird in the air, the victim is often killed by the mere shock. But if it seizes a hare or a lamb, then the prey is carried off alive to the rock on which the eagle lives.

5. When a bird of prey pounces, the weight of

its body bends the legs, and so closes the talons. It cannot then let go the prey, as long as the legs are kept bent; just so it is impossible for a percher to fall off its perch while it sits down keeping its legs bent beneath it.

6. Therefore as an eagle clutches its prey, it puts the weight of its whole body into the action; the sharp curved talons are thus driven into the heart of the victim, while the eagle screams fiercely with pleasure over its victory. An eagle has been known to carry off a child.

7. The male and the female birds remain together throughout the year. They are most dangerous while the eaglets are in the nest. They generally hunt in pairs, one eagle watching from a height while the other courses along near to the ground. The eye of an eagle can be adjusted to see objects very near, or at a great distance.

8. The nest of an eagle is called an aerie. The greater part of the rocky ledge, upon which the aerie is built, is used as a larder for storing food. The nest itself is roughly made of sticks and bushes.

9. The American eagle is known as the bald-eagle because of its white head feathers. The bald-eagle is found in every part of this country, and its majesty and strength account perhaps for the choice of the bird as the emblem of the United States.

LESSON 10.

A NIGHT BIRD.

whisk'-ing	valves	stom'-ach	plum'-age
screwed	en-cir'-cle	e-ject'-ed	cock-a-too'
scratch	di-gest'	snooz'-ing	build'-ings
cav'-i-ties	pel'-lets	screech	su-per-sti'-tious

1. The barn owl is sometimes called the white owl, although its plumage has really different shades of buff, with touches of white, gray and black. The under part of the male is pure white. The young owlets are just like little puffs of white down.

2. The owl has been called a night-prowler. It lives near the abodes of man, and is often found in the neighborhood of farmyards, where it feasts on the mice which do so much damage to the harvest fields and the stored grain.

3. The formation of the feathers on all owls is such, that instead of being stiff and smooth, like those of birds of prey which hunt in the daytime, they are loose and fringed at the edge, so as to prevent that rushing sound which the flight of an eagle or a hawk always makes. An owl is therefore as noiseless in its movements as a cat.

4. The eyes of an owl are round and staring. They are set in front of the head, and both can

be brought to bear on an object at the same time, but cannot be turned. When an owl wishes to see around him he has to turn his head; he has the power of twisting his head round, till you could almost fancy it was being screwed off.

5. Not only are the eyes of an owl full and



A BARN OWL.

round like those of a cat, but when he is angry he hisses like a cat, and will even lie on his back to fight and scratch with his claws as a cat does.

6. The owl is exceedingly sharp of hearing. The large head has two cavities to assist the sense of hearing. The ears outside are also large but

are concealed between two large valves. From the edges of these proceed the feathers which form the outer ring of the disk which encircles the face of an owl.

7. The valves can be drawn apart to let in sound when the bird is listening intently. Being so noiseless and working in the silence of the night, he cannot fail to catch the slightest sound.

8. The sharp, hooked beak and the strong talons, which can be drawn back into sheaths like a cat's, at once show the owl to be a bird of prey. Owls have no crops, and swallow their prey very freely. The indigestible portions of the food, such as bones, feathers, beaks and claws of birds are rejected by the stomach, brought up and ejected from the mouth in the form of small pellets.

9. The owl lays its three or four eggs on a mass of these disgorged pellets, instead of in an ordinary nest. The barn owl is useful to the farmer, because it devours, not only mice, but large numbers of beetles and other destructive insects.

10. The largest of American owls is the great horned owl. It preys upon small animals and other birds. Its home is usually near some marshy spot in the lonely forests. Its fierceness and strength have led to its being called a "tiger among birds."

11. Sleeping and resting in seclusion by day, it

comes forth by night into the open and inhabited parts to swoop silently down upon unwary and suitable prey. This large owl is more common in the western states.

12. The snowy owl comes from the cold north and only visits us during the winter.



THE HORNED OWL.

The smallest and perhaps most common of owls is the hoot owl, a terror to whisking field-mice, baby bunnies and superstitious people.

13. The mice and bunnies have just cause to dread its presence, but no person need fear its dismal cry, for it is only a call to its lonely mate. In olden times the screech of the owl was believed to foretell some trouble or disaster, but most people know better in these days.



LESSON 11.

THE OWL.

gloom'-y	pris'-on-er	thrice	rent
plight	ghost'-ly	fond'-er	per-haps'

Mourn not for the owl, nor his gloomy plight !

The owl hath his share of good :

If a prisoner he be in the broad daylight,

He is lord of the dark greenwood !

Nor lonely the bird, nor his ghostly mate,

They are each unto each a pride ;

Thrice fonder perhaps, since a strange, dark fate

Hath rent them from all beside !

BRYAN W. PROCTER.

LESSON 12.

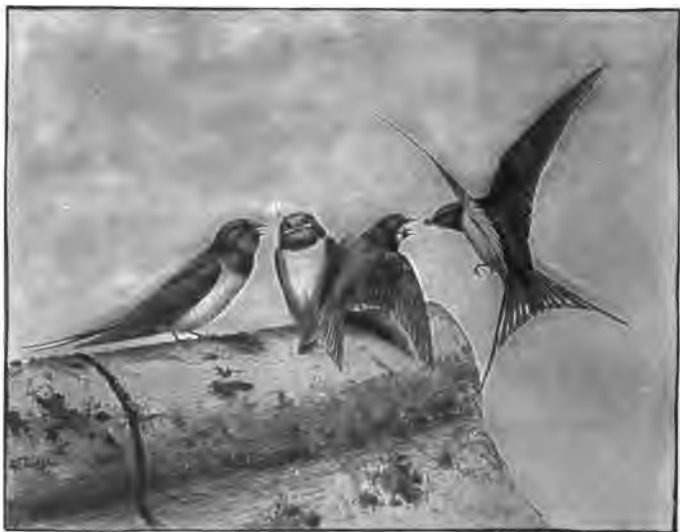
ATTRACTIVE HOMES AND THEIR BUILDERS.

se'-ri-ous-ness	en-er-get'-ic	or-na-ment'-ed
per-plex'-i-ties	pro-nounced'	hand'-i-craft
gnarled	li'-chen	ar'-chi-tec-ture
in-ter-twined'	lat'-tice	in-va'-sion
ap-pro'-pri-ate	phœ'-be	sa-li'-va
re-sourc'-es	ad-van'-tage	vir'-e-os

1. As birds flit from tree to tree, or dart playfully about, there seems little of seriousness in their

lives. Yet a close study of their ways reveals cares and perplexities peculiar to bird life.

2. The anticipation of a brood of feathered babies necessitates the building of a home. Nooks and crannies must be investigated and a location agreed



SWALLOW FEEDING YOUNG.

upon. Then material suitable for the building of the nest must be found and gathered.

3. The Baltimore oriole's swinging nest is a sample of prudence and skill. Far out on the branch of an elm it hangs, moored there with greatest care. The strongest materials are placed

at the top of the nest. First they are intertwined and fastened about the branches and twigs, then, with many a loop and turn, they are cleverly woven through the body of the nest in order to brace and balance it.

4. Twine, cord, yarn, hempen fibres torn from milkweed stalks, horsehairs, pigs' bristles, plant down, wool and feathered wings of seeds, all have a place in the oriole's nest. In localities where hawks are numerous these nests are built much longer and are more closely drawn together at the top, in order to conceal the mother bird and fledglings.

5. The nests of the vireos are among the daintiest of bird cradles. They are cup-shaped and pendent. One side of the nest is fastened with cocoon-silk to a branching twig, while the other side is allowed to swing free. The rim of the nest is soft, thick and smoothly rounded, making a famous perch.

6. Bark from birch trees and grapevines, leaves, pieces of hornets' nest, bits of wood and other material may be found in a vireo's nest. These birds have a pronounced fondness for newspapers and cast-off snakeskins. When these prized materials can be procured they are placed to the best advantage in the nest.

To add the finishing touches the nest is orna-

mented with meshes, tufts and twisted threads of snowy white cobweb. These decorations are the features of the vireo's handicraft.

7. But there are architects and masons among the birds as well as weavers and artists. Even the catbird's nest in the tangled cedar branches is a clever piece of bird architecture. Gnarled twigs are loosely bound together with strips of bark or rags, or artfully interwoven until the nest is firm and equal to one season's needs.

8. Robins are careless builders and pay a due penalty. The loose masonry of their nests is often broken up by a drenching rain, and the fledglings perish on the ground. Beams in outbuildings and corners in rail fences offer the robins greater security from storm, but not from the red squirrel's invasion.

9. The phoebe is a mason too. The home site is carefully chosen. Some cranny on the piazza or in an outbuilding may be favored with a nest. It is built of mud and moss, is exquisitely finished, and furnished with a mattress of feathers or hair.

10. The homes of the swallows are interesting too. The bracket-like nest of the barn-swallow may be found beneath the span of a bridge or under a beam in the barn. It is constructed of mud and straws and well lined with feathers. 'Tis a clever arrangement of crude materials!

11. The chimney-swift's house consists of a lattice of twigs glued together with saliva or tree-gum, and fastened to the inside of a chimney or hollow tree. It usually accommodates two broods, though it is a scanty structure.



A SWALLOW'S NEST AND EGGS.

Bank-swallows tunnel in the side of a sandy cliff and line the excavation with feathers shed by neighboring birds.

12. Many are the attractive homes built by the

birds. Among the rocks overgrown with lichen, and in the tall meadow grasses, as well as in the trees and cosy crannies, bird houses may be found. Birds adapt themselves to their surroundings, use the material at hand, and prove by their happy ingenuity that "only poor workmen find fault with their tools."

LESSON 13.

BY THE WATERSIDE.

PART 1.

wa'-ter-side	brink	cyg'-net	pur'-ple
grace'-ful	snow'-y	car'-pet	sor'-rel
awk'-ward	al'-lowed'	pat'-tern	scar'-let
in-deed'	fe'-male	patch'-es	i'-ris
chief'-ly	brav'-er-y	fringe	crowned

1. On a hot summer day it is cool and pleasant to walk by the waterside.

2. On the lake in the park we may see some beautiful swans. The swan, like the duck, belongs to the goose family.

3. The swan is the largest bird found in this country. We like best to see it in the water, because it is such a graceful swimmer. It seldom comes on land, and always looks rather awkward there. When sailing on the water its size and beauty make it, indeed, a noble-looking bird.



SWANS.

4. Like geese, swans feed on plants ; they live chiefly on the roots and seeds of water-plants, and on the grass that grows near the brink. They hiss when they are angry ; and they strike with their wings just as geese do.

5. The feathers are snowy white, the bill is red, and the legs are black. Although they are tame birds, swans are allowed to make their own nests of reeds and rushes on some quiet part of the bank, not far from the water's edge.

6. The hen lays six or seven eggs. Both the male and the female will defend their nest with great bravery. A young swan is called a cygnet.

7. Now let us leave the park and go out of the town, away into the country. There we shall find a clear running stream. We will walk along its banks for a mile or two.

8. What a soft, cool carpet we have to walk upon ! The pretty pattern in it is made by dots of daisies and patches of buttercups. The river banks here are steep, and tall wild flowers fringe the water.

9. Here dainty mosses and graceful vines clothe the rugged rocks, while the purple iris waves its flag-like leaves as scepters over its marshy realm, and nods its kingly head in approval to the message of the breeze.

LESSON 14.

BY THE WATERSIDE.

PART 2.

in'-ter-est-ing	nerv'-ous	quest	nymph
has'-socks	ex'-qui-site	ex-am'-ine	charm'-ing
pro-trud'-ing	glimpse	gleam'-ing	move'-ments

1. How restful and quiet it is by the pond! We must take care where we step, for the ground is soft and damp. If we are quiet, too, we may be well repaid, for there are some very interesting but timid creatures along the waterside.

2. Look out on the ragged hassocks of grass just beyond! See those brownish looking lumps! Are they bunches of grass or stones? Surely not, for now some of them are moving and we can see their long, protruding necks. Are they turtles? Yes, they are really turtles that have come up, from their home in the mud below, to get a sun-bath.

3. Now peep over into the cattails and see that roll of grass so carefully hung among them. Watch quietly, you may find out what it is. Suddenly a tiny bird flies out of a hole in the side. The long bill and nervous movement tell at once that it is a marsh wren, and the queer little roll of grass is its nest.

4. What a strange bird note, "con-quer-ee!"

con-quer-ee!" floats to our ear, while the passing of a black bird with orange-red patches on his wings shows that the red-winged blackbird has a home somewhere near. In a low bush we may find it with the dusky mother bird caring for her pale blue eggs.

5. Among the low willows we may look for the exquisite little nest of the yellow warbler. Perhaps we may also get a glimpse of this golden-robed sprite as it flits about in quest of grubs and insects.

6. And why are those gleaming dragon-flies darting about over the water? If we examine some of the water weeds, bunches of little eggs may be found upon them. These eggs belong to the dragon-fly. Both the egg and nymph may be found in the water, while the full-grown insect lives upon the land.

There are many more interesting creatures about the waterside. Look for them!

LESSON 15.

SNAKES.

skel'-e-ton	liz'-ards	ser'-pents	clothed
in'-ter-vals	squeez'-ing	di-am'-e-ter	slim'-y
tor'-tois-es	meas'-ur-ing	al'-most	rat'-tle-snake
croc'-o-diles	pois'-on-ous	al-though'	in-clude'

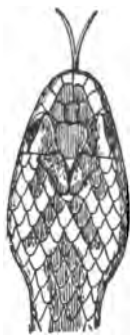
1. The word *reptile* means "a creeping thing"; but all creeping things are not reptiles. A real

reptile has a bony skeleton, and its body is covered with a thin skin and is clothed with plates or



AN ADDER.

scales. The skin is shed as it comes out in the spring from its winter's nap.



HEAD OF A SNAKE.
(Showing arrangement of scales.)

2. The young of a reptile are produced from eggs, hatched after they are laid. As soon as the young appear they resemble their parents. For this reason we know that frogs are not reptiles, as they first appear in the form of tadpoles.

3. Reptiles include tortoises, crocodiles and lizards, but the best known group is that of the snakes.

4. Most people are afraid of snakes. They call them nasty, slimy things, fancy they

possess poisonous breath, and that they will attack, and sting a man to death.

5. As a matter of fact no snake is slimy ; only a certain portion of them are poisonous, and the poison is dealt by a bite and not through the breath, nor by a sting of any kind.

6. In other countries snakes are sometimes very large. The largest snakes are the boas. Some of these giant snakes are twenty to thirty feet long, and as thick as a man's body. They have no poison fangs, but kill their prey by squeezing it to death.

7. Although a snake has no legs, no wings, no claws and no fins, it is by no means a helpless creature. It can leap, run as fast as a horse,

swim, climb trees, dart from branch to branch, and move quickly enough to capture birds. Its whole body acts as a hand, a foot or a fin.



A BOA.

8. A snake swallows its food whole, and in almost every case the food consists of living animals measuring more in diameter than the reptile itself.

9. Some snakes have two long teeth or fangs in their upper jaws, with poison bags at the roots of them. When these serpents bite their prey, poison is squeezed out of the bags or glands, and is squirted down through a tube or canal in the tooth into the wound of the victim.

LESSON 16.

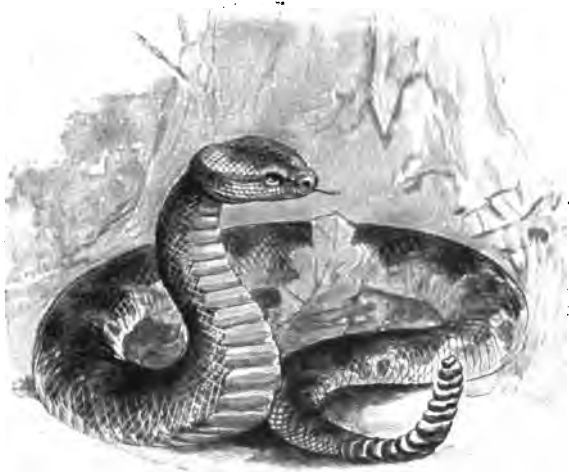
VENOMOUS AND NON-VENOMOUS REPTILES.

ven'-om-ous	ver'-ti-cal	e-rects'	con-stric'-tion
di-ag'-on-al-ly	in'-no-cent	re-pel'-lent	cop'-per-y
in-ject'-ed	grat'-i-tude	fledg'-ling	struc'-ture
blotched	e-las'-tic	tor'-por	di-min'-ish-ing

1. In America there are but two species of poisonous reptiles, the rattlesnake and the copperhead. These snakes are not very common; each year they grow less numerous.

2. The rattlesnake, so called because of the bony rattle at the end of the tail, measures from forty to sixty inches. It is dark brown in color, diagonally marked with brown, black and tan. When angered the snake erects its fangs and

strikes. This presses the tooth back against the venom sac and squeezes out the poison, which passes through a channel in the fang and so enters the wound. The bite is very dangerous, though not always deadly.



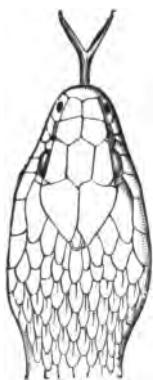
A RATTLESNAKE.

3. The copperhead measures about one yard. The head is very flat and has a coppery cast. Its color is brown above with darker blotched markings. The fangs are like those of the rattlesnake. It has no warning rattle and is a most dangerous reptile.

4. Poisonous snakes differ in appearance from the harmless ones. Venomous reptiles have fangs

and few teeth. The pupil of the eye is vertical and there is a deep pit on the side of the face between the eye and nostril. The harmless snakes have no fangs, both jaws have a full set of teeth, and the pupil of the eye is round.

5. While it is wise and necessary to destroy poisonous reptiles, it is quite wrong to kill harmless ones. The garter-snake, the blowing adder, the little green snake and others are innocent and helpful creatures.



HEAD OF THE
GARTER-SNAKE.

6. Snakes feed upon rats, mice, moles, insects, grubs and slugs. All these do great damage in the field and garden, and much gratitude is due to the repellent reptile for diminishing the number of these pests.

7. The black snake or racer is harmless, but ugly in appearance. It climbs trees with ease, and robs birds' nests of eggs or fledglings. The black snake kills its prey by constriction, that is, it winds its body about the victim and squeezes out the life. By this same method it wins in a battle with other snakes, even with the rattlesnake.

8. Snakes can swallow prey broader than themselves. This is possible because of the wide-open jaws and elastic structure. They pass the

winter in a torpor. Snakes show no gratitude, no affection; the senses are dull and sluggish. They seem void of any commendable traits, save the appetite that does away with harmful and annoying pests.

LESSON 17.

FOND MOTHERS AND UGLY BABIES.

ug'-ly	plen'-ti-ful	search	e-merg'-es
fair'-y-like	knob	hun'-gry	per'-fect
del'-i-cate-ly	gen'-er-al-ly	cat'-er-pil-lars	gnats
scales	or'-phan	wrapped	coiled

1. All mothers love their babies. If a baby is ugly, its mother always says that it will be sure to grow into a good-looking man or woman.

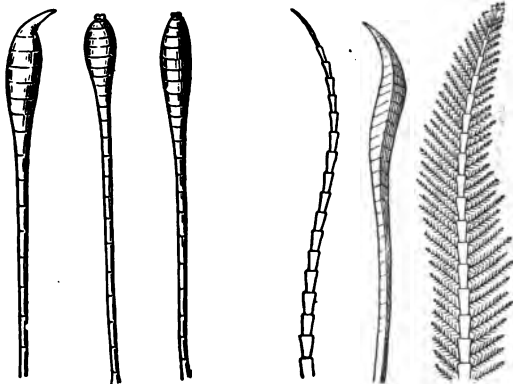
2. Many insects are certainly ugly when they are young; yet they become quite beautiful when they are full-grown.

3. The strange thing about all insects is the number of changes they have to go through before they become perfect. An insect is never born in the form by which we know it.

4. We often say a thing is "as beautiful as a butterfly." And truly a butterfly has a very fairy-like form. Its wings are often large, and yet so delicately and prettily formed. If we merely touch a wing, the beautiful scales that mark it come off on our hands like powder.

5. It is only in the warm weather, when flowers are plentiful, that we see butterflies about. This is because they live on the juice of flowers, which they suck through a little trunk. This trunk, or tongue, is coiled up when not in use.

6. On the front of the head a butterfly has a pair of feelers. On the end of each feeler is a little



ANTENNÆ OF BUTTERFLIES.

ANTENNÆ OF MOTHS.

knob. Moths have no knobs on their feelers. These feelers are called antennæ. A moth's body is usually heavier and more hairy than that of a butterfly. Butterflies fly by day, and moths at night.

7. The butterfly has to flit about over long distances in order to find sufficient feeding-places on which to lay her little eggs. She may be dead before her orphan children are born, and they will



BUTTERFLIES AND MOTH.

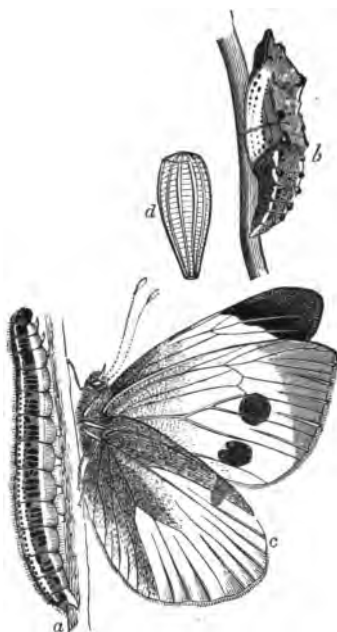
1. Scales or Dust on a Butterfly's Wings : highly magnified.
2. Scales or Dust on a Moth's Wings : highly magnified.

need a great amount of food. As they will have no wings to carry them in search of food, it must be near at hand and ready for them.

8. Besides, how could such a delicate mother nurse a large family of strong, hungry babies, such as hers will be when the warm sun has hatched her eggs? And what kind of babies will they be? Why, they will be grubs or caterpillars, nothing like the butterfly! Some caterpillars really make themselves ugly on purpose to frighten away birds and other enemies.

9. A caterpillar eats many times its own weight. It keeps on eating so much that its skin becomes too small, and at last cracks open. Out comes the caterpillar in a larger skin. The ravenous eating continues until the grub has similarly changed its coat four or five times.

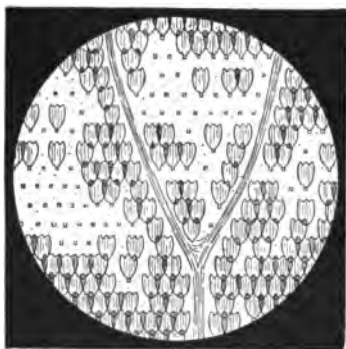
10. When the caterpillar can eat no more, it



THE FOUR STAGES IN THE LIFE OF
A BUTTERFLY.

a, larva; *b*, pupa; *c*, imago; *d*, egg.

spins a tiny silken thread and fastens it to a leaf, or to the stem of a plant, or perhaps to a piece of wood. Here it sheds its skin for the last time and looks very different; it resembles a baby wrapped up in very tight clothes. But a great change goes on beneath the cover, and at last a perfect insect emerges.



PORTION OF THE WING OF A BUTTERFLY FROM WHICH SOME OF THE SCALES HAVE BEEN REMOVED.

11. All insects go through these changes — flies, gnats, bees, beetles and all others. First the egg; then the grub or caterpillar; thirdly, the pupa, or “baby form”; and at last the perfect insect.

12. At first the insect is very weak, and its wings are wet and useless. But it soon gets quite strong, and in an hour it is flying gayly about in the air. Yet after all these changes an insect’s life is a very short one.

LESSON 18.

AN INSECT'S DISGUISE.

in-quired'	grav'-el-ly	float'-ing	ex-act'-ly
cur'-rent	slen'-der	de-ceived'	dis-guis'-ing
eag'-er-ly	ar'-mor	sur-round'-ed	liq'-uid
plas'-tered	chrys'-a-lides	se'-cret	hol'-low

1. Two boys were walking one pleasant summer day along the banks of a little stream. Suddenly one of them stopped and began to stare at the water.

2. "What are you looking at?" inquired the other boy.

3. "Just look at that bit of gravel on the top of the water. Did you ever see gravel float before?"

4. "Never. But look again! Why, it is moving against the current of the stream! Can you understand that?"

5. "No. But I'll soon find out what it all means!" And without another word he took off his shoes and stockings, waded into the water, and caught the strange little craft in his hand.

6. When brought to land the prize was eagerly examined by the two boys. They found it to be round, and about an inch in length. But it was not all gravel; for from one end there peeped out a little horny head and six slender legs.

7. "Oh! it's alive! Why, it's like an insect plastered all over with a coat of dirt!" exclaimed



CADDIS-CASES.

one. Then the boys wanted to know all about this strange little sailor. So they carried it to their father, who knew a great deal about insect life.

8. "It is a caddis-worm," said he. "If it lives long enough it will turn into a caddis-fly — one of those delicate insects with large, brown wings which you may have seen along the brookside."

9. "But how did it get covered with gravel like this?" asked the boys.

10. "The stream, you know, has a gravelly bed, and the caddis-worm got these bits of stone from the bottom of the stream, and stuck them all together with liquid glue from its own mouth. Many caterpillars, the silkworm for instance, can produce a gummy liquid which hardens into silky threads.

11. "If you examine this caddis-case, you will see that it is a little hollow tube of gravel, lined inside with silk to make it comfortable."

12. "But how did it make the gravel to float on the top of the water? And why did it want to make such a strange rough-looking coat of armor at all?"

13. "I will tell you. No doubt you wondered when you saw grit floating on the top of the water. Here is the secret of that wonder. You will notice that the little creature has made his case light enough to float by building a bit of twig into it. You may also observe that this 'float' keeps at the top, and projects over at one end as a protection to the head.

14. "This strange covering is not so heavy as it looks, and he can draw it along wherever he goes in his search for water-plants and small insects; he can float it at the top or sink it to the bottom, whichever he wishes.

15. "As to the reason for all this, the creature does it as a protection against the fishes and the numerous other enemies that are always lying in wait to devour him. In disguising himself as a bit of gravel he certainly deceived you, and hoped in the same way to escape the notice of his enemies.

16. "Had the brook possessed a sandy bottom the caddis-case would then have been built of sand. A friend of mine kept some caddis-worms in glass jars, covering the bottom of each jar with a different material. The caddis-cases were consequently built of a different material in each jar. In each jar it was impossible to distinguish the caddis-case as it lay on the bottom amidst the other material.

17. "I went to see one little creature at work. He got together the bits with which he was surrounded, and after putting them into the right position, stuck them firmly together with a few licks.

18. "When full-grown, the caddis-worms fasten their cases to a stone or a water-weed, close up the ends with silk, and turn into chrysalides.

19. "After a time, having thus cleverly escaped life's dangers, they move to the surface of the water, and out creep those pretty little four-winged caddis-flies."

20. "Well," said the elder boy, "it seems to me that the caddis-worm knows how to play a very good game of 'Hide and Seek' with its enemies!"

LESSON 19.

HIDE AND SEEK.

anx'-ious	sim'-i-lar	ex-ist'-ence	prompt'-ly
mim'-ic-ry	breeze	sway'-ing	em'-er-ald
glu'-ing	dis-tin'-guished	ob'-ject	pre'-cious

1. Next day the father took his two boys for a walk. Presently they saw a moth flutter past them.

2. "Look at that moth, and mark the spot where it alights," said the father. "Now go up to the place and find the little creature."

3. The two boys ran off eagerly to find the moth. They searched all round the spot where they thought the moth had alighted, but were unable to see it anywhere.

4. When their father laughed at them, they became the more anxious to know how it was that the little moth had escaped them.

5. "It often happens," said their father, "that

moths and butterflies partake very much of the color of their surroundings. For instance, the moths that are found in this neighborhood are of a dark hue, like the surrounding rocks. Had the moth which fluttered past you been of a pale color, you could easily have spied it out."

6. "But of what use is this coloring to moths and butterflies? Surely you don't mean to say they can make themselves any color they like?"

7. "Oh no! But this is what happens. Insects have many enemies that are always on the look-out for them. Hence it comes about that on dark-colored soils like this, all the pale-colored insects fall a ready prey to the birds. Each year only the darker ones are left in any numbers. As the search becomes keener, only the very darkest are left at last.

8. "So that on dark soils dark-colored insects may be plentiful enough, while pale ones are exceedingly scarce. Or if there should be a large number of birch trees growing in a place, you need not be surprised to find that there the insects generally have gray shades on their wings, somewhat similar to the gray, silvery bark of the birches. A whole colony of gray harvestmen may sometimes be found resting upon the rough bark of old birches, apparently aware of the safety of their position.



INSECT MIMICRY.

9. "Wherever an insect can alight upon a tree trunk, and it appears there to be nothing more than a natural scar in the bark, it seems to know that it has found protection from the keen eyes of its deadly foes.

10. "The same species of insect living in two different places may have two different shades of color. Those of the lighter shade will always be found living over a lighter colored soil, and those of the darker shades where the surroundings are also dark."

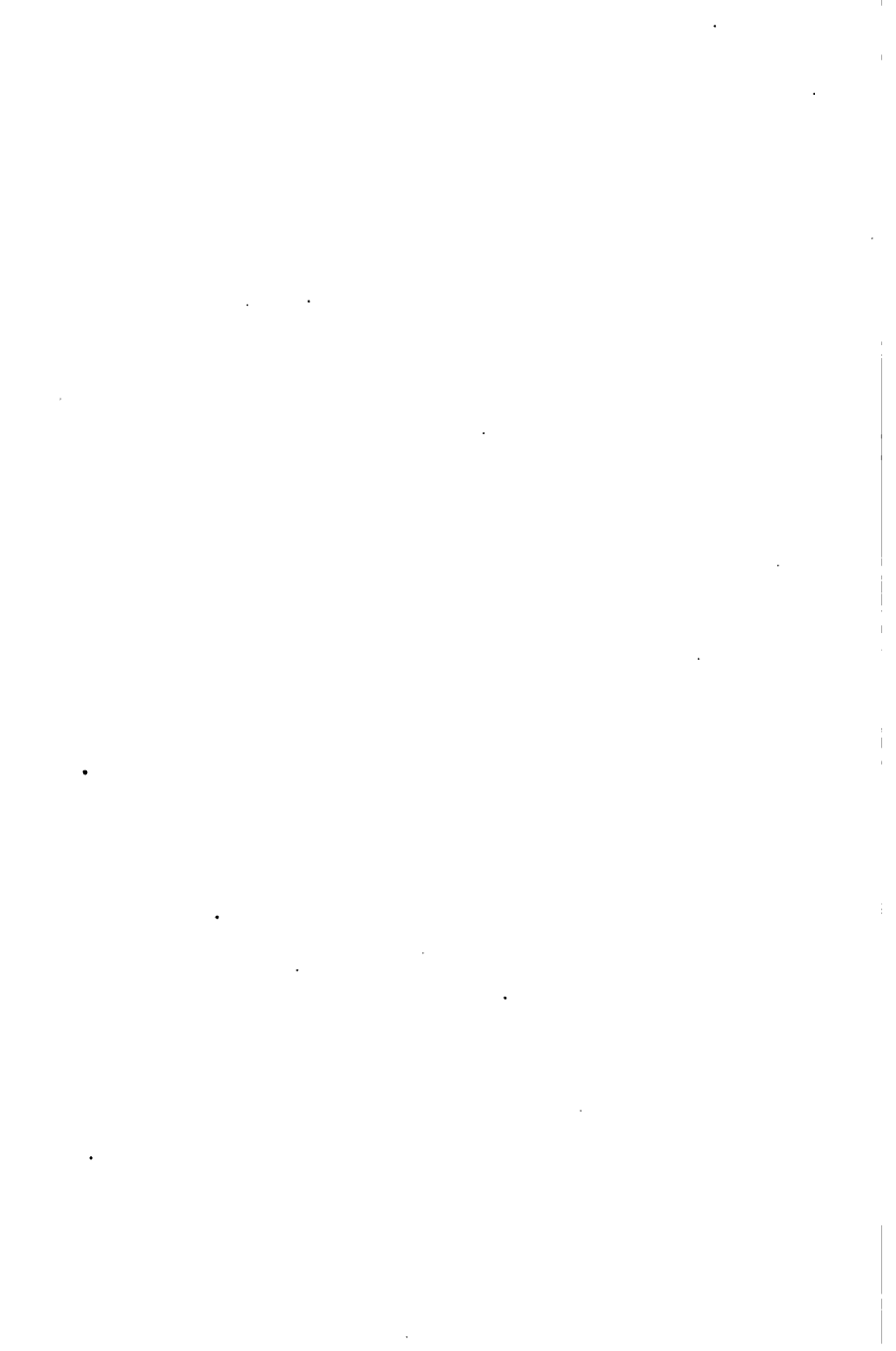
11. "I have noticed," said the elder boy, "that trout are very difficult to see in yonder stream, because their color is so much like that of the shingly bottom."

12. "Yes, the color of trout will vary, according as they swim in a clear, shallow stream, or inhabit a deep, duller pool amid darker surroundings. Rabbits and hares differ in different localities, according to the soil they live upon. The fur of those in some parts of England is of a ruddy hue, because the clay there is red. Some species of the snowy, northern regions have fur that is entirely white."

13. For a time the boys walked on in silence, thinking over all that they had just heard. Their father was the first to speak. Pointing to what looked like a dead, brown leaf hanging from a



PTARMIGAN IN SUMMER AND WINTER CLOTHING.



branch by a tender stalk, and swaying to and fro with every breeze that blew, he said, "What is that?"

14. "A leaf," promptly replied the younger boy. "No, it is not," said his father. "Don't touch it."

15. Even when the elder boy had looked more carefully, they both still thought it was a leaf. But when their father put his finger gently towards it, the stalk proved to be the legs, and the leaf to be the wings of a moth.

16. "This is a walking leaf," said he. "It is thus we see how helpless creatures preserve their lives by pretending to be some lifeless object."

17. "A similar little mimic is the leaf insect which is found on the orange tree. Its wings are perfect imitations of the orange leaf, even to the veinings of the sap channels; it hangs quite stiff, and seemingly lifeless, and is so much like one of the ordinary leaves that you might hunt for it a long time and yet never find it."

18. "In the struggle for existence, the shamming of the emerald moth is still more wonderful. This moth preserves itself by biting off little pieces of the plant on which it feeds, and gluing them all over its body with the glue from its own mouth. In this disguise it cannot be distinguished from the plant which it is devouring."

19. "If the more helpless creatures that cannot escape from their foes by flight, and are quite without means of defense, did not thus protect themselves by all sorts of mimicry and pretense, they would be preyed upon until they were destroyed. This is especially true of some of the smaller birds, fishes and insects.

20. "But stranger still, animals do not always suit their forms and their colors to their surroundings in order that they may hide from their foes. There are some which disguise themselves for the purpose of stealing upon their prey unnoticed, and without causing untimely alarm.

21. "So that in the animal world a very deadly game of Hide and Seek seems always to be going on!"

LESSON 20.

THE LITTLE SPINNER AND WEAVER.

an'-cient	flu'-id	hav'-oc	cen'-ter
ap-pend'-ages	e-las'-tic	dul'-ly	re-pos'-ing
spin'-ner-ets	weight'-ed	glit'-ter-ing	neigh'-bor-ing
pro-ceeds'	dew'-drops	hid'-ing	vel'-vet

1. The word spider means spinner. There is a very ancient tale of a Greek maiden, who was a beautiful weaver, being turned into a spider.

2. A spider is not an insect. An insect always has six legs; a spider has eight. A spider is born a

spider ; an insect is always hatched from an egg, and always has to live through several changes before reaching its perfect shape. And there are other differences beside these.

3. Spiders capture insects for their prey, and some of them spin webs for this purpose. Near the end of the abdomen, spiders have from four to eight finger-like appendages with tiny holes in them. These are called spinnerets, and from them proceeds the silk which forms the cobweb. It is



A LARGE SPIDER.

stored in a gland or bag, where it is a thick, fluid-like gum.



SPINNERETS.
Much enlarged.

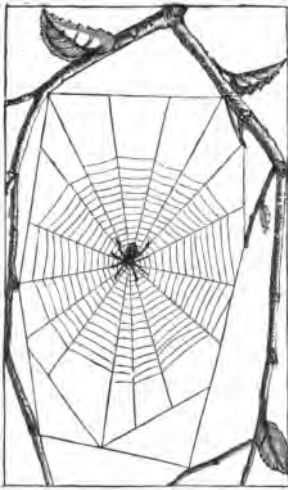
4. When a spider wishes to spin, it squeezes some of the fluid out through the holes of the spinnerets. This fastens where it drops ; as the spider moves its body along a slender thread is drawn out, which hardens as it reaches the air.

5. It is not a single line, but several coming

from various spinnerets, and being spun into one strong cord. It is very elastic, and will keep in position when shaken by the wind, or when weighted with the heavy dewdrops of morning.

6. Cobwebs may be out of place in a room, but in a garden they are in their proper place. For here they catch a vast number of insects which

would work havoc among the flowers, fruits and vegetables. A wise gardener will not suffer garden spiders to be killed.



THE SPIDER'S WEB.

7. A web is a beautiful fabric. Sometimes the spider may be seen reposing in the very center of it, hanging with its head downwards, after the fashion of the bat. Sometimes it is under a neighboring leaf that it lurks in its soft, velvet-like coat, waiting

and watching for its prey. It has eight jet-black eyes that dully glitter in the darkness of its hiding-place. With what a rush it pounces forth upon some unlucky fly!

LESSON 21.

COBWESBS.

ap-proach'	stead'-ied	dam'-aged	break'-ages
lim'-it-ed	var'-i-ous	as-cend'-ing	con-struct'-ed
scaf'-fold-ing	vi'-o-lent	pre-vent'	de-cayed'

1. Spiders are capital weather-glasses. They never make or mend their webs except at the approach of fine weather.

2. Their supply of silk being limited, it is far too valuable to be wasted on wet weather, when the flies will stay at home. Should spiders be seen busy at work while the weather is still wet, there is certain to be a change shortly afterwards, and the fair weather will last for some days at least.

3. It is most interesting to watch spiders at work making their webs. First a scaffolding is constructed of strong lines. This spreads out from a center, star-shape, and is steadied by guy-ropes which fasten it to the various points fixed upon by the little weaver.

4. Then the fine spiral threads which catch the prey are wound round and round, and stuck to the framework by little knobs of sticky fluid. It is very wonderful how the spider directs the thread. Holding it carefully by one hind claw to

keep it well away from her body, she gives it a pull each time she fixes it to one of the frame lines, to make sure of its firmness.

5. Once a garden spider had its web under the shelter of the eaves of a cottage. One day a violent storm of wind raged through the garden, and damaged the cobweb by breaking one or two of its guy-ropes. Of course the web then flapped about like a loose sail in a storm.

6. The spider did not make new guy-ropes. She was seen to lower herself by a thread to the ground, and then to crawl to a spot where the wind had blown some pieces of decayed wood out of the fence.

7. To one piece of this rotten wood, about three inches long and of the thickness of a slate-pencil, she fastened a line. Then ascending to her web she hauled up the bit of wood to a height of nearly five feet, and left it hanging by a line to her web.

8. The effect was wonderful. The weight of the wood was enough to hold the web tight, and yet at the same time to sway with the wind, and so prevent further breakages. Clever little spider!



LESSON 22.

THE BUTTERFLY'S BALL.

drag'-on	vi'-ands	har'-le-quin	gnat
plum'-age	haunch'-es	min'-u-et	dex-ter
com-pan'-ion	di-ver'-sions	ma-jes'-tic	ga'-zers

1. "Come, take up your hats, and away let us
haste

To the Butterfly's Ball and the Grasshopper's
Feast,

The Trumpeter, Gadfly, has summon'd the crew,
And the revels are now only waiting for you."

2. And there came the Beetle, so blind and so
black,

Who carried the Emmet, his friend, on his back.
And there was the Gnat and the Dragon-fly too,
With all their relations, green, orange and blue.

3. And there came the Moth, with his plumage of
down,

And the Hornet in jacket of yellow and brown;
Who with him the Wasp, his companion, did
bring,

But they promised that evening to lay by their
sting.

4. And the sly little Dormouse crept out of his hole,
And brought to the feast his blind brother, the
Mole.

And the Snail, with his horns peeping out of his
shell,
Came from a great distance, the length of an ell.

5. A Mushroom their table, and on it was laid
A Water-dock leaf, which a tablecloth made.
The viands were various, to each of their taste,
And the Bee brought her honey to crown the
repast.

6. Then close on his haunches, so solemn and wise,
The Frog from a corner look'd up to the skies,
And the Squirrel, well pleased such diversions to see,
Mounted high overhead and look'd down from a
tree.

7. Then out came the Spider, with finger so fine,
To show his dexterity on the tight-line.
From one branch to another his cobwebs he slung,
Then quick as an arrow he darted along.

8. But just in the middle — oh! shocking to tell,
From his rope, in an instant, poor Harlequin fell.
Yet he touch'd not the ground, but with talons
outspread,
Hung suspended in air, at the end of a thread.

9. Then the Grasshopper came with a jerk and a spring,
 Very long was his leg, though but short was his wing;
 He took but three leaps, and was soon out of sight,
 Then chirp'd his own praises the rest of the night.

10. With step so majestic the Snail did advance,
 And promised the Gazers a Minuet to dance;
 But they all laughed so loud that he pulled in his head,
 And went in his own little chamber to bed.
 Then as Evening gave way to the shadows of Night,
 Their watchman, the Glowworm, came out with a light.

T. ROSCOE.

LESSON 23.

CREATURES WITHOUT BACK-BONES.

high-er	per'-i-win-kle	or'-gan	frag'-ments
no'-tice	gen'-er-al-ly	suc-ces'-sion	blu'-ish
cen'-ti-pedes	rayed	crev'-ice	se-clu'-sion
mus'-sel	car'-a-pace	act'-u-al-ly	hu'-man

1. Did you ever notice what a great number of animals are back-boned creatures? For instance, all the mammals, birds, reptiles and fishes have skeletons of hard bone.

2. But a large number of animals, generally the smaller ones, have no back-bone at all. There are two kinds of well-known creatures which have no back-bone. First there are the "jointed animals," and secondly the "soft-bodied animals."

3. Of jointed animals there are five great classes: the worms and leeches with bodies made up of rings without limbs; the centipedes made up of rings with many pairs of legs; the crusted animals; the spiders with four pairs of legs; and the insects with three pairs of legs. All of them have bodies made up of rings jointed together. In many cases these rings may be easily seen with the naked eye.

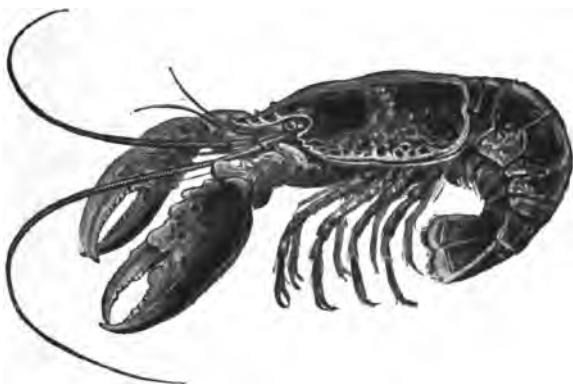
4. Among the soft-bodied animals are such creatures as the snail, the periwinkle and the oyster. Their bodies, having no skeleton, are so soft that they have to be protected by an outside shell. Sometimes the shell is all in one piece; sometimes it is in two plates, as is the case with the oyster, the mussel and the clam.

5. There are even lower forms of life than these. There is the starfish, for instance, which belongs to the "rayed animals," and scarcely looks like an animal at all. This is the third kind of animal having no back-bone.

6. Among the jointed creatures has been named the class of "crusted animals." To this family

belong such creatures as crabs, lobsters and shrimps. Instead of a shell, these animals have a kind of crust or armor to protect their soft bodies; they are all water-breathers.

7. The lobster's body is encased in a crust of rings, those of the hind part are jointed, so that the body may bend and curve. The head shield is called the carapace; to it are attached two pairs



A LOBSTER.

of horns or feelers. The eyes are set on short stalks. The body is deeper than it is broad.

8. Attached to the body are five pairs of walking legs; one of the first pairs serves as an anchor to hold fast when the sea is rough; the other pairs are weaker. On the under side are six pairs of small legs for swimming.

9. The fan-like tail of the lobster is its great

organ of motion ; it is very powerful, and enables the creature to spring a great distance when it is alarmed. Lobsters spring tail foremost, and can direct their course so cleverly, that they can pass through a hole which is scarcely larger than the size of their bodies.

10. Their eyes being on stalks enable them to see backwards. Their under legs merely enable them to swim forward, and that but very slowly.

11. Lobsters are hatched from eggs ; they cast their coverings, and after several moults resemble their parents. Then they grow by a succession of moults. Once in each year the creature ceases to feed, and retires to some crevice in the rocks. It grows thin inside its shell, which becomes loose, and finally splits open. By an



A LOBSTER'S EYES.
Much enlarged.

effort the animal creeps out of its old shell, and for a time is soft and defenceless. It then rapidly grows so large that its old shell could not possibly contain it.

12. In a week or two the skin hardens to form a new shell, larger than the one just cast off. The lobster then comes from its seclusion and resumes its old active life for another year. This process of

moulting goes on each year till the lobster is full grown.

13. In drawing its great claws from their old covering, they are forced through the openings at the joints, which are actually smaller than the claws themselves. This seems a wonderful thing to do.

14. If a lobster gets a claw injured, it has power to throw it off, and a new one then grows in its place. While one large claw may be used as an anchor, the other has sharp teeth which are used to tear its prey to fragments.

15. The color of a lobster is bluish-black on the back, but when it has been boiled for food it turns red.

LESSON 24.

CRABS.

ar'-mor	di-vi'-sion	pu'-ri-fy-ing	sub'-stance
in'-jured	ed'-i-ble	scav'-en-gers	va-ri'-et-y
un-yield'-ing	at-tract'-ed	quar'-rel-some	se-vere'-ly
re-pro-duc'-ing	there-in'	pos-sess'-ing	es-cape'
dis-tinct'	hab-i-ta'-tion	garb'-age	cleanse

1. The common crab, like the lobster, is a crusted animal, wearing jointed armor and possessing ten legs; but it belongs to the short-tailed variety. Its short tail is bent underneath its body.

2. Its unyielding armor is cast off every year, even to the covering of the eyes and the lining of the stomach. Like the lobster, the crab possesses the power of casting and reproducing an injured limb. When a crab is found with one claw smaller than the other, it is because the new one, in place of the cast one, has not had time to grow to its full size.

3. The hard shell is all in one piece on the broad part, or the body, of the crab. But this broad part also includes the head; for there are the two eyes set on footstalks. We generally find the eyes of animals on their heads, or on the front part of their bodies.

4. In all the back-boned creatures, the head is distinct from the chest; but this is least so in the fishes, which have little or no neck. Fishes, however, form the lowest class of the back-boned animals. In crabs there is not the slightest trace of a division to be found between the head and the chest. So on this ground, too, a crusted animal is very different from a back-boned creature.

5. The edible crab—the one we buy at the fish-market to eat—cannot swim, but crawls about, generally just below low-water mark. The mouth being in the middle of the chest, the food is tucked into it by the claws. The stomach lies closely against the head.

6. Crabs are not only fond of living prey, but they devour any dead fish they find, or other animal substance that may be floating about ; so they are useful in purifying the water. They are the scavengers of the sea. Crabs are quarrelsome ; they fight, kill and eat each other.



A HERMIT CRAB OUT OF ITS SHELL.

7. Fishermen catch them by letting down baskets, called crab-pots, weighted with stones, to the sea bottom. These baskets are so constructed that the crab may get in easily enough, but cannot find its way out again ; they are attracted to the trap by bait which is placed inside it.

8. The claws are strong and pinch most severely. When the fisherman draws up his basket, he ought to kill the crab at once, by stabbing it beneath the tail; for the crab pretends to be dead for the first few minutes after it is caught, and lies quiet. This pretence is made, however, only that it may find some way to escape.

9. When eating periwinkles, did you ever find a little hermit crab occupying one of the shells? This is another kind of crab.



THE HERMIT CRAB IN THE
SHELL OF A WHELK.

10. The hermit crab is formed in two distinct parts: the head and a good portion of the body are covered with shell like the fore part of a lobster; the tail portion is bare, soft, and without any solid protection whatever.

11. To defend these soft parts the creature seizes and uses those shells best suited to its purpose. It seizes the victim, often a whelk, just behind the head. After killing it, Sir Crab proceeds to eat it out of house and home, and then to take up his residence there himself.

12. When feeding or walking about, the head and chest of the hermit crab project beyond the mouth of the shell; but when alarmed he draws

himself in altogether, and closes the opening of his stolen house with one of his claws which is much larger than the other.

13. The crab holds on firmly and cannot be torn out of its stolen shell. But as he increases in size he has to change his habitation. This is done when crawling along a line of shells left on a low beach by the last wave. The crab tries each likely one by slipping his tail out of the old house into the new one, till at last he finds comfortable quarters in a more roomy shell.

14. These crabs also eat garbage and dead fish, and so cleanse the coast after each retreating tide.

15. At one time it was thought that the stolen shell really belonged to the hermit crab, just as much as his own jointed armor. Crabs are as wonderful as they are useful. Just think of the difference between a man and a crab. If a man injures his leg very badly, the doctor cuts it off, and provides him with a wooden or cork one. But a crab or a lobster can grow an entirely new limb.



LESSON 25.

PEARL MAKERS.

PART 1.

pro- tect '-ing	hinge	cur'-rent	spi'-nal
whelk	fringe	threads	low'-er
vast	bi'-valve	af-fixed'	shown
mus'-sel	ir'-ri-ta-ting	stead'-i-ly	flat'-tened
mus'-cle	shal'-low	edg'-es	man'-tle

1. By this time we have learned how important it is to an animal to have a back-bone. All the higher animals have this series of bones running up the back, and crowned by the skull bones, for protecting the spinal cord and the brain.

2. The lower animals have no back-bones. They seem to abound everywhere. The water swarms with these lower forms of creation. The soft-bodied animals are among the highest of the boneless animals.

3. The oyster, like the clam, scallop, mussel and whelk, belongs to the soft-bodied creatures. Oysters have no limbs of any kind with which to move about. In this respect they seem little above the plants to which they attach themselves.

4. In their very early lives, or in the embryo stage, as it is called, they are in a free condition and are carried about by the currents below the

surface of the water. But they soon attach themselves to some suitable surface and from that time have no power to move from one place to another.

5. The oyster possesses a number of useful organs. It is protected by two shells, and is therefore called a "bivalve" — *bi* meaning "two," and *valve* meaning "door." These work on a strong hinge, and can be drawn closely together by a very powerful muscle. When you have eaten an oyster you may see the scar inside the shell which shows where this muscle was fastened to it.

6. One shell is somewhat flattened and the other is more rounded. Each shell is lined with a smooth coat of pearl on which the soft body may rest with comfort; but outside, it is rough and made of thin plates one over the other, as if to stand rough usage at the bottom of the sea.

7. When we open an oyster we see its body lying flat between the shells. It has two dark flaps nearly surrounding the whole of the body, and commonly known as the beard.



AN OYSTER.
(Showing gills.)

These flaps are really the gills, and between them is enclosed the mouth, which is shown by white lips.

8. The oyster has a mouth to eat with and gills to breathe with; and yet it has no limbs to move about, and no power to put either its lips or its gills outside the edges of its shell. How then does it feed, and how does it breathe?

9. If we place a living oyster in a shallow pan of sea-water and watch it closely, we shall see that it will soon partly open its valves, and that a current of water will run steadily between them. This current is produced by the action of a vast number of little fringe threads which are affixed to the gills. By their waving movements these cause the water to flow over and between the gills, and past the lips.

10. In sea-water there is a vast number of living creatures too tiny to be seen, besides particles of other animal and vegetable matter. These form the food of the oyster. So the current set up by the oyster's own gill-fringe carries to it both food to eat and air to breathe, for there is always air in the water of the sea.



LESSON 26.

PEARL MAKERS.

PART 2.

de-mand'	at-tach'	dis-trib'-u-ted
ar-range'-ment	fag'-ots	ex-ten'-sive
sen'-si-tive	col'-o-ny	prod'-uct
dis-turb'-ances	whelks	na'-cre-ous

1. As the demand for oysters is very great it becomes necessary to arrange for a large supply. In order to meet this demand, for food, as well as for the nacre, or mother-of-pearl, that lines their shells, oyster beds are made in favorable places, and planted with young oysters.

2. These young creatures are very sensitive to any great change in temperature, or to any unusual movement of the currents, and many perish from such disturbances. Young oysters require clean surfaces to which they may attach themselves, as well as a sheltered position, and oystermen are very careful in the arrangement of these things.

3. Pieces of broken shells, pebbles, bundles of sticks tied together, and broken crocks are scattered over the sea-bottom, in order that the young oysters may fasten themselves to them and live and grow. Along coasts, various seaweeds, or

rockweeds, offer excellent opportunities for the attachment of embryos.



YOUNG OYSTERS UPON A PIECE OF
ROCKWEED.

4. Oysters that grow under such conditions are more perfectly formed than those with which less care is taken. When they develop at the sea bottom the more hardy ones are apt to overlap and literally swallow up a smaller one. So, we see that the struggle for existence goes on in the sea as well as on the land.

5. Millions of young oysters perish before they have attached themselves to any surface, and many more millions afterward. Various creatures of the sea seem to recognize them as a delicacy just as people do. Perhaps you are

wondering how it is that so many can perish and a supply still be left for the market. But you will

not be surprised when you hear that one mother oyster may produce from five to six millions of eggs in one year.

6. If we could journey as the fishes do among the oyster beds, what strange things we should see! An oyster bed may be said to be a mixed colony indeed. Friends and foes are to be found there together. The crabs are friends and companions.



AN OYSTER WITH ONE SHELL REMOVED.

They eat up the decaying matter and keep the oyster district clean.

7. Sponges and clams do no further harm than to rob many an oyster of its dinner; but many deadly enemies refuse to quit the inviting spot, and are content with no less than the pearl-maker's life. Among these enemies are whelks, boring-sponges and worms, drums, drills, and even some fishes.

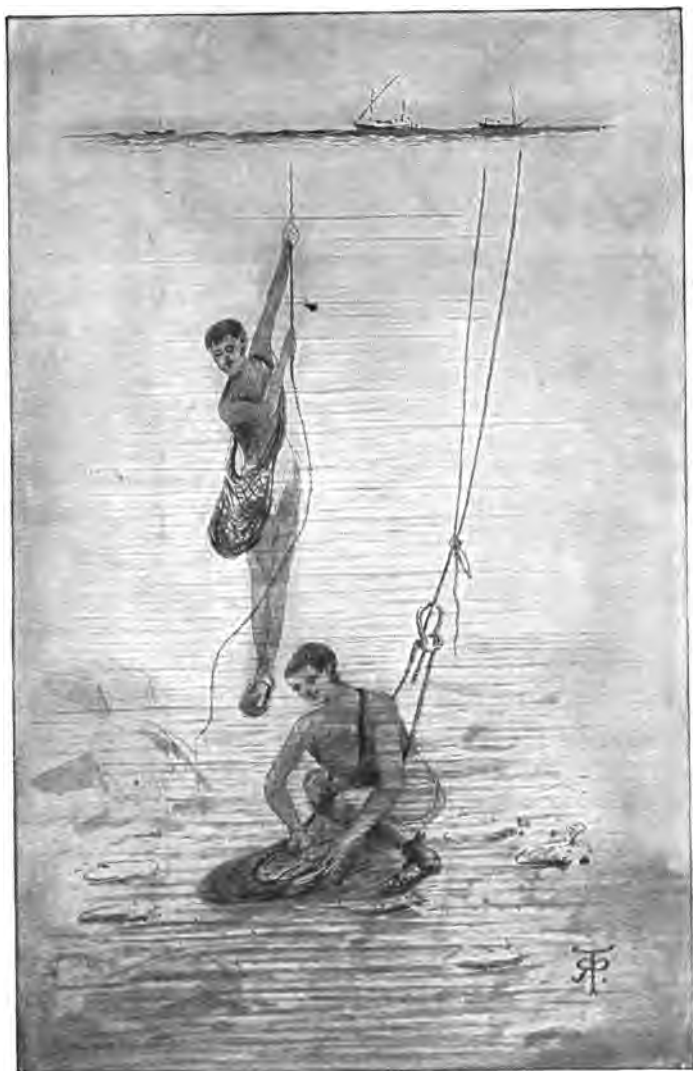
8. The pearl oyster is widely distributed in the tropical seas. It is native there. Pearl fisheries are carried on for the sake of the nacre or mother-

of-pearl lining. The extensive Australian fisheries are carried on for this product. A trained diver is let down from a boat to the bed of the sea, his descent being assisted by means of a heavy weight attached to his foot. He remains under the water from fifty to eighty seconds, gathering the shells within his reach. This is hard work, but the pearls sometimes found have great value.

9. A very good quality of pearl oysters is found along the coast of China. The Chinese have a peculiar way of obtaining mother-of-pearl idols. Small idols cut from thin pieces of copper or tin are carefully inserted between the mantle and the shell of the oyster. The oyster is then returned to the water with its unwelcome guest.

10. This foreign substance is a source of irritation to the little pearl-maker, and it at once goes to work to cover up the idol by coating it with the same pearly substance as lines its shell. Layer after layer of this nacreous matter covers over the idol until it is well coated. If the oyster lives, it is taken up at the end of two years and the idol is removed.

11. But how about the pearls used in jewelry? It is believed that some grain of sand or some tiny parasite enters the shell of the oyster and in due time becomes coated, as the little idol does, with



DIVING FOR PEARL OYSTERS.

the nacreous matter and becomes a pearl. Shells that are perfectly formed seldom contain a pearl; 'tis the dwarfed, irregular, honeycombed shell that is most likely to hold the jewel.

12. Pearls are sometimes irregular and some-



times perfectly round, or globular; these are the most valuable. The most perfect pearl is said to be in a museum at Moscow; it is entirely globular, and of peculiarly beautiful

colors. Oysters at four or five years of age yield the best pearls. Pearl oysters are sometimes found in clear water in *atolls*, as the ring-shaped coral islands of the tropics are called; but they are mostly taken from the deeper water on the coasts of Australia and other tropical countries.

13. The fresh-water pearls come from the fresh-water mussels. They are usually duller and darker, and of much less value than those from the sea. Pink pearls come from the great conch shells of the West Indies. Black pearls come chiefly from the pearl oysters of the Gulf of Mexico. They are rare and very valuable.

LESSON 27.

THE SCALE OF ANIMAL LIFE.

grad'-u-al-ly	ma-ture'	a-nem'-o-nes	group
in-cludes'	un'-i-valves	for'-tu-nate	piece
lungs	zo'-o-phyte	scale	sim'-ply
suck'-lers	re'-al-ly	di-vid'-ed	stroll

1. We now begin to see that there is a scale of animal life, starting with the highest animal, man, and coming down gradually to the lowest forms of animal life.

2. The Animal Kingdom is divided first into two parts. The higher half includes those animals which have skulls and back-bones. The lower division takes in all those creatures without back-bones.

3. In the higher division there are five classes of animals. First, the mammals, or sucklers, which are warm-blooded, and seem to be more or less covered with hair or fur. Secondly, the birds, which are also warm-blooded, but are produced from eggs and are covered with feathers.

4. Thirdly, the reptiles, which are produced from eggs, but are cold-blooded; they breathe by lungs and are sometimes covered with scales or plates. Fourthly, the double-lived creatures, such as frogs and toads, which live both on land and in

water ; these are produced from eggs and are cold-blooded ; they breathe by gills when young and by lungs when mature. The fifth and last class of the higher animals is that of the fishes, which are cold-blooded and breathe by gills.



A WHELK.

5. Of the second division of the Animal Kingdom, or those creatures without back-bones, we have already learned something. We know that soft-bodied animals have to be protected by shells, and that these outside shells give the shape to their bodies, quite as much as an inside skeleton of bonework might do.



A PERIWINKLE.

6. Some have two shells, or two valves, and hence are called "bivalves," such as the oyster, the scallop and the mussel. Some have but one shell in a single piece, and are therefore known as "univalves," as the periwinkle and the whelk.

7. We have also learned something of the jointed animals, as the spiders, insects, crabs and worms. Then there is a third group; these are the rayed animals, or those that spread out in rays from a center, as the starfish does. Jellyfishes and zoophytes belong to this group of rayed animals.

8. Zoophyte is simply a hard-looking word which stands for "plant-

animal," a name which reminds us that once they were supposed to fill the place between animals on the one hand and plants on the other. They really



A JELLYFISH.

do look very much like growing plants, and yet they have a mouth and a stomach, and feed as animals do.

9. Those boys and girls who are fortunate enough to have a trip to the seaside in the summer holidays, may take a stroll along the seashore to pick up seaweed, and to search for pretty shells. If they come to any rock pools, they may hunt for some of those wonderful animals which we know by the name of sea anemones.

LESSON 28.

PLANTLIKE ANIMALS.

PART 1.

search'-ing	storm'-i-est	dis-ap-pears'	splen'-did
spec'-i-mens	nour'-ish-ment	car'-ing	press'-ure
ten'-ta-cles	eye'-sight	sing'-u-lar	de-vour'-ing
bead'-let	twist'-ing	es-pe'-cial-ly	e-ject'-ed

1. In searching for sea anemones, way should be made to a low-lying rock, and the best time will be when the tide is very low.

2. Peering into a rock pool, it is often easy to find a cluster of liver-colored specimens with pink rays, or feelers, or, to call them by their right name, "tentacles."

3. These rays are placed around the mouth, and

between them and the body is a row of blue beads which are sometimes mistaken for eyes. There is a thin line of the same bright blue around the base of the animal where it sticks to the rock.

4. This specimen belongs to one of the most common species, and because of its bright blue beads, this anemone is called the beadlet. It sticks to the rock by its flat base acting like a boy's sucker; and the stormiest sea cannot move it. Yet it can move itself by sliding along on its base somewhat as a snail does.

5. Clearly, an anemone is not a plant. It is not fastened to the rock by roots which gather up nourishment for it, as do plants which are rooted in the soil. The anemone has a body; it consists of a sort of fleshy bag, at the top of which is a small opening or mouth encircled by the rays which serve it as hands. Although it has a mouth it has neither head nor eyes; its mouth opens into its stomach, and its rays are such excellent feelers that it has no need for eyesight.

6. These singular organs are sometimes longer than the body, and are kept in constant motion, twisting about like so many young snakes. Whenever a shrimp or a small fish comes within reach, the rays secure it, the mouth then opens, and the prey disappears. A day or two afterwards the mouth opens again, and the lifeless body is thrown

out, the anemone caring only for the blood, of which it has sucked the body dry.

7. Searching further among the rocks, especially under the seaweed, many other species of these soft, fleshy-bodied anemones may be found. They have different tints, but are mostly brown, or liver-colored, when they are closed up.

8. Presently, however, the splendid flowerlike top may be seen to unfold itself. Stooping down, this expanded blossom may then be touched with the finger. At once the petals begin to close, the finger is seized, and is held not by pressure only, but by a sticky fluid as well.

9. After feeling this, no one will wonder that a wandering crab or a luckless shellfish should sometimes fail to escape from this pretty-looking but devouring monster, whose big stomach is so near his ever-ready mouth. An anemone will take in a scallop, shell and all; the next day the undigested remains of the shell will be ejected by the mouth.





ANEMONES.

One, the green opelet, is emerald green, with nearly two hundred long, rounded rays, each beautifully tipped with pink, ever on the move and always expanded. This one is fond of swimming, and can rise to the surface of the water by filling itself with air till it is like a bladder.

5. The gold-spangled anemone has a bright pea-green coat covered with golden spots; its rays are transparent, with green bars across them.

6. The parasitic anemone is a great drab-colored specimen with creamy and purplish rays, and is fond of fastening itself on to a whelk shell which has a hermit crab living inside. Sea anemones are creatures as beautiful as they are curious.

LESSON 30.

CORAL PRODUCERS.

crev'-ices

ex-ag-ger-a'-tion

se-crete'

gor'-geous

sed'-i-ment

fath'-oms

or'-gan-isms

bar'-ri-er

ex-ten'-sive

cor'-al-lines

en-cir'-cling

cy-lin'-dric-al

1. As the land has its wealth of flowers to adorn its meadows and fringe its forest paths, or cluster among the crevices of the bold gray rocks that wall the mountain side; so the ocean has its gardens of gayly blooming life. But this sea-life is a step above the plant-life that adds beauty to

our earth ; for these gorgeous flower-like forms are living animal organisms.

2. Closely allied to the sea anemones are the coral polyps. They are beautiful, and delicately so. One writer on Ocean Life states that the corallines are unsurpassed in beauty. He also asserts that it is hardly an exaggeration to say that their tints and hues, as seen through two or three fathoms of clear water, surpass those of the rainbow.

3. Corals require pure sea-water and warmth. Therefore they may not be found where fresh-water streams mingle with the ocean's waters, or where currents are carrying sediment, or on tropical shores that are bathed by Arctic currents. They also require a rock bottom on which they may fasten. It is believed that they cannot live at a greater depth than twenty or thirty fathoms.

4. These coral polyps live in extensive colonies. The coral structures built by them have various forms. Some are branched, like tree-forms ; others are brain-like, or chain-like ; some appear as delicate fans or wave with the passing currents as frail and graceful feather-forms.

5. But these strange little creatures have been instruments to add to the prosperity of man, as well as to adorn the ocean depths. For the great coral reefs of the Pacific and Indian Oceans have

been upbuilt by them, and many groups of islands and solitary islets in these two great oceans are built entirely of coral.

6. Coral reefs are named according to their relations to the shore. *Fringing reefs* lie close to the shores of islands and continents, and are sometimes called *shore-reefs*. *Barrier reefs*, at some distance from the shore, rise from a greater ocean depth and stretch like a barrier along the coast. An *atoll* is a circular reef surrounding a body of water.



AN ATOLL, OR CORAL ISLAND

7. Atolls were once the boundary line of an enclosed island that subsided, or sank, after the upbuilding of the encircling reef. Many of the rocky and picturesque islands of the Pacific lie

within these encircling reefs. A strip of rich land generally surrounds the base of the mountains and a girdle of palm trees separates the rugged rocks from the calm, blue water from which they rise.

8. The reef-builders are the oldest monument builders. Sturdy rocks break and crumble away, but the coral reefs stand against the continual thunder of the waves, and the work of the tiny coral polyps checks the force of the mighty breakers.

9. Perhaps you have sometimes heard the coral producers called "coral insects." This is a mistake: they belong to the plantlike animals, being much lower than insects in the scale of life. They are only soft-bodied organisms which have power to secrete lime and some other hard substances that form coral.

10. The body of a coral polyp consists of a cylindrical skin with an inside sac, which proves to be its stomach. The top is bordered by thread-like appendages or tentacles, which seek and draw the food into the sac or stomach. When the tentacles are opened out the creature has a flower-like appearance.

11. The lower end of the polyp is fastened to the stony substance. The *limy* substance that forms the coral is secreted between the stomach and the outer skin of the polyp. The hard or

lower end and the soft or upper end of the little coral producer are inseparably joined when the animal is in a healthy condition.

12. In very early life the polyps are free and move about in the water, but this soon ends and the little animal fixes itself to the stony structure built by its ancestors, after which it is powerless to detach itself. The cells of the coral colony are not like houses into which the polyps may come and go at pleasure, but part and parcel of the creature itself.

13. Coral polyps do not collect from any external source the material used in forming coral, more than that they select from the water that which sustains their lives and is made by natural processes into coral. But the steady work, day and night, of myriads of these creatures serves to check the proud breakers and furnishes the otherwise barren ocean expanse with rich and beautiful islands.



LESSON 31.

ORNAMENTAL CORALS.

dol'-phin	mod'-elled	en-tan'-gled
mag-nif'-i-cent	hem'-i-sphere	oc-cu-pa'-tion
nymphs	com-plex'-ioned	dredg'-ing
em'-u-la-ting	com-po-si'-tion	sym-met'-ric-al

1. Doubtless you have all heard the story of Neptune, the sea-god, and his wonderful palace in the ocean depths. Deep down under the tossing waves, on the floor of the ocean, it stood, surrounded by the wonders of the sea and guarded by water nymphs with their attendant dolphins.

2. The walls of Neptune's palace were made of pink sea shells, each one of which was a setting for a great white pearl. The roof was of magnificent coral, and the floor was covered with matchless sea mosses and glistening sands. The houses of the sea nymphs were all more beautiful than any upon the earth. The waves made music for these sprites, lulling them to sleep or accompanying them in their frolic amid the dashing spray.

3. Coral was called by the Greeks, "The Daughter of the Sea." Doubtless this was in appreciation of its beauty, but they seemed to know little of its origin or the strange plant-animals that are necessary to its existence. Pro-

fessor Dana has given a very beautiful description of the wonders of coral growths and forms.

4. He says, — “Trees of coral are well known, and although not emulating in size the oaks of our forests — for they do not exceed six or eight feet in height — they are gracefully branched, and

the whole surface blooms with coral polyps in place of leaves and flowers.



CORAL FOUND IN THE INDIAN OCEAN.

5. “Shrubby, tufts of rushes, beds of pinks and feathery mosses are most exactly imitated. Many species spread out in broad leaves or folia, and resemble some large-

leaved plant just unfolding. When alive, the surface of each leaf is covered with polyp-flowers.

6. “The cactus, the lichen clinging to the rock, and the fungus in all its varieties have their numerous representatives. Besides these forms imitat-

ing vegetation, there are gracefully modelled vases, some of which are three or four feet in diameter, made up of a network of branches and sprigs of flowers.

7. "There are also solid, coral hemispheres like domes among the vases and shrubbery, occasionally ten or even twenty feet in diameter, whose symmetrical surface is gorgeously decked with polyp-stars of purple and emerald-green." Under such circumstances one is not surprised at the fancies of the ancients connected with ocean life!



RED CORAL.

(A small detached portion magnified.)

8. Specimens of coral are most desirable for cabinets. One can imagine the delight of the coral fisher when some rare piece of coral is brought up by his net or by the dredging machine. The chief coral fisheries are along the coast of Algeria and Tunis.

Here the corals are sorted, packed and sent to Europe.

9. They are then cut and polished for the necklaces and other ornaments which are so much admired. Red coral is the most desirable; it is very hard and capable of being highly polished. While the more lacy corals sway with the moving tides, the red coral is stout enough to withstand the usual movement of the waters.

10. Great quantities of coral are sent to India. It is much admired by the natives of that country and is cheap enough for many of them to procure. The blood-red corals are preferred by this dark-complexioned people, while the fairer Europeans prefer those of a roseate or pinkish hue.

11. There have been many strange ideas regarding corals. For instance, that they were of a soft vegetable composition, that hardened upon coming to the air; or that in a free condition they were soft, but turned to stone from very terror upon becoming entangled in the fisher's net. Great labor is connected with the coral fisheries and frequently much disappointment, but a few rich finds now and then serve to encourage the coral fisher to continue his occupation.

LESSON 32.

PLANT LIFE.

range	per-form'-ance	shrubs	bur'-ied
re-mem'-ber	li'-chens	ri'-pened	king'-dom
par-tic'-u-lar	spores	min'-er-al	de-pend'
con-cerned'	or'-din-a-ry	an'-swer	doubt

1. We have all seen many different kinds of plants. We have observed how plants differ from



A PLANT, SHOWING ROOT, STEM, LEAVES AND FLOWERS.

each other in size and shape, in color and appearance.

2. They range from the giant tree to the tiny

blade of grass ; from the sober-colored evergreen to the brightest of pretty flowers.

3. Most of us could easily name the different parts of a plant — the roots, the stem, the branches, the leaves, the buds, the flowers and the fruit or seeds.

4. After a little thought, we should no doubt remember that the root of a plant is that part of it which is always present ; the stem nearly always ; while the leaves, flowers and fruits are present only at certain seasons of the year.

5. Just as in an animal there are various parts, or organs, as they are called, which have some particular work to perform, such as the mouth and the stomach, whose work is concerned with the feeding of the body ; so in plants there are organs for the performance of various duties.

6. For instance, in a plant, the root, the stem and the leaves are all concerned in the work of its nourishment ; while the flowers are concerned with the production of the seeds, from which new plants may grow.

7. Plants, like animals, die in due time ; and if there had been no seeds to carry on plant life, after a time all the plants would have disappeared from the earth.

8. Some plants produce flowers from which their seeds are ripened. These are therefore classed as the “flowering plants” ; in this class

we have all the ordinary trees, shrubs and the thousands of green herbs.

9. There are other plants which never bear flowers; they have strange organs instead, which give rise to germs equal to seeds, but which are called spores. To the class of "flowerless plants" belong ferns, mosses, lichens, seaweeds and mushrooms.

10. If a plant is a growing thing it is easy to understand that it must be a living thing.

11. Now if we dig up a stone, we shall notice that we find the whole of it in the earth; that it has no parts or members such as we call organs; and that one piece of it is very much like another, except so far as the pieces may differ in size and shape, according as we happen to have broken it.

12. It certainly does not increase or grow in any way; therefore it cannot in any sense be a living thing.

13. So if we were asked to name the differences between a plant and a mineral, we might answer that a plant has several members, while a mineral has none; that a plant has always one part in the soil, whereas the whole substance of a mineral is found buried in the earth; and that a plant grows, while a mineral never does.

14. The whole of nature is divided into three

great classes or kingdoms : the Animal Kingdom, the Vegetable Kingdom and the Mineral Kingdom.

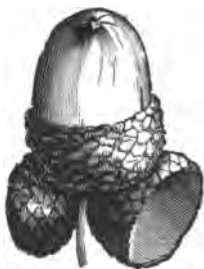
15. The vegetable lives very largely on the mineral, and there are many animals that live solely on vegetables. Without minerals there would be but few plants ; if there were no plants there would be no vegetable-eating animals ; and the flesh-eating animals would soon kill and eat each other off the face of the earth.

16. Thus we may see how the three Kingdoms of Nature depend upon each other.

LESSON 33.

SEEDS.

warmth	starch'-y	ber'-ry	cher'-ries
mois'-ture	sprout	scold'-ed	su'-gar
re-quired'	med'-i-cine	o'-pi-um	cas'-tor
a'-corn	juic'-y	choc'-o-late	sweet'-ened



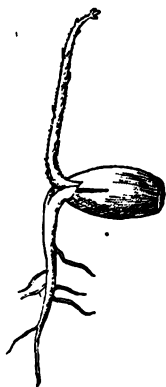
AN ACORN.

1. A seed is a wonderful little thing. It is generally very small, yet it contains within itself the germ or simple beginning of every part of the plant into which it will grow — the root, the stem and the leaves. A mighty oak is contained within the shell of a small acorn.

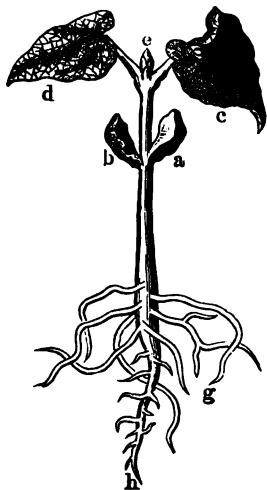
2. Warmth, moisture and air are all required to make plants

grow. Some seeds and plants require more warmth than others, and will only grow in warm countries, or when kept in hothouses in a cold country.

3. When the seed becomes warm enough, it absorbs or sucks in the moisture; it begins to grow and soon needs more room. The skin or case which has kept it from cold and injury then bursts, and the baby plant sends down first a root into the ground, and then a stem up into the air.



AN ACORN SPROUTING.



A YOUNG BEAN PLANT.

ab, cotyledons; *cd*, leaves; *e*, bud.

4. Seeds are divided into two great classes: those which have inside them one seed lobe or seed leaf; and those which have two seed lobes. In those seeds which contain one seed lobe the plant food, which is to feed the baby plant, is stored up in the seed. Those seeds containing two seed lobes have the starchy food for the baby plant or germ stored up in the seed lobes themselves.

5. When the skin of a bean or a pea is removed, the young

plant is found within, consisting of a tiny root and stem, with two large lobes ; these lobes are thick and fleshy, and make up the bulk of the seed.

6. A grain of wheat has only one seed lobe, but it contains a store of the starchy food (the white part of the grain) which is to feed the young plant.

7. For some little time after a seed begins to sprout, it cannot get its own nourishment out of the soil ; it is for this reason that the food is stored up within the seed, ready for the young plant to live upon.

8. When a seed is sown in the ground, it soon feels the moisture and the warmth, and the germ, or baby plant, contained within it at once begins to sprout. The little root begins to shoot out through a hole in the skin, and to bore down into the soil for the purpose of drawing up nourishment to feed the new-born plant. For nothing can grow unless it is fed.



A GRAIN OF WHEAT
SPROUTING.

9. Seeds are intended to provide that the species of plant on which they have grown and ripened shall never fail and die out, but shall go on reproducing new plants when the old ones on which they grew are dead or dying.

10. But man has discovered that seeds are use-

ful to him for a great variety of purposes. We make use of seeds in many ways.

11. There are some seeds that are eaten as food, such as grains, peas, beans and nuts, all of them of various kinds. Apples, pears, figs, oranges and a great many other fruits are simply seed-holders.

12. Some seeds are used for making drinks, as the beans of the coffee and the cocoa plants, which are prepared with boiling water. Some are used for flavoring food, as mustard, pepper and nutmeg.

13. Some again are pressed in order to squeeze out their oil; in this way castor oil, olive oil, and rape seed oil are obtained. Linseed oil is obtained from flax seeds, and is largely used in the mixing of paints; cocoanut oil, sometimes called butter, is largely used for greasing machinery. Mustard oil is used as a medicine. In cases of aches and sprains, it is applied to the skin by rubbing. The effect is warming and soothing.

14. Besides the castor oil and the mustard oil, there is another medicine obtained from the seeds—or rather, the seed case—of a plant, and a very wonderful one too. This is opium, which is made from the milky juice of the poppy's seed pod, and is used largely in medicine to lull pain and put people to sleep.

15. Seed holders are sometimes eaten when they

are fresh and juicy, as in the case of cherries, plums, and other fruits. Some seeds, as peas and beans, are dried and eaten for food.

16. Sometimes seeds are dried and ground to powder, as is done with pepper and wheat. Sometimes they are roasted and ground, and afterwards scalded, as in the case of the coffee berry. Sometimes they are mashed and sweetened with sugar, as we prepare cocoa-beans in order to make them into chocolate.

LESSON 34.

THE SWALLOWS.

squeal'-ing	jour'-neys	gloss'-y	ap-plause
wel'-come	sign'-post	nes'-tling	des-cry'

1. Welcome, merry May, and you,
 Pretty swallows, welcome too :
 How I wish your little beak
 Could of all your journeys speak —
 Through the months of frost and snow,
 You were absent long, I know.
 Once, I think, I knew by heart
 All your different kinds apart,
 Four of you there used to be —
 Are you all come back to me ?

2. Yes, I see you every one
Gayly sporting in the sun ;
One, without a speck of white,
Squealing, flies at such a height,
Still in circles, by the hour,
Wheeling round the old church tower ;
Though he looks so very small,
He's the largest of you all.



A SWALLOW.

3. One, that just before me flew,
Seems of such a glossy hue !
On his breast, they say, is spread
Just a little coat of red ;
But so swift he sweeps me by,
I can scarce his form descry.

Now I think he'll hit my face —
Then he's gone at such a pace,
I could almost think 'twere true,
That he's here and yonder too !

4. Ah, and now I see a third,
What a clean and pretty bird !
All his breast so white and pure,
He must wash it well, I'm sure !
Now he lights against the wall —
Take care, martin, you will fall !
No, his forkèd tail he sticks
Like a prop against the bricks ;
There he hangs with clinging claws
Looking round to ask applause.
5. What a tiny dusky swallow
Flits in yonder sandy hollow ;
Underground he makes his house,
Nestling like a little mouse ;
See, they're flying all about
By the sand hole in and out.
Over land and over sea
You are all come back to me,
And your weary wings you rest
Each within his last year's nest.
6. I can see no guide to lead you,
I can see no nurse to feed you,

Map or signpost you have none,
And yet each his home has won.
Away, away from southern lands,
Northward haste, oh, swallow bands!
You are welcome to the cot,
That you never have forgot.

LESSON 35.

DAISY TIME AND DANDELION CLOCKS.

straight	feath'-ered	bal-loon'	scat'-ter
fan'-ci-ful	pap'-pus	waft-ed	crack'-les
flor'-et	dan'-de-li-on	furze'-pods	syc'-a-more
fluff'-y	jour'-ney	stroll'-ing	crim'-son

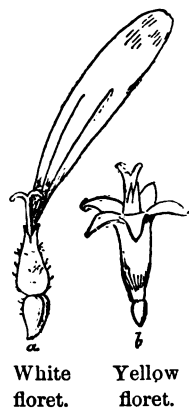
1. Although a daisy may be found in the spring-time, it is in the month of June that the meadows are white with them. They grow so closely together that when all of them are in full bloom the fields look as if they had been covered by a slight fall of snow.

2. The hardy daisy grows among the grass. It does not hang its head, but looks straight up into the sky. At night its white petals close up into a little round ball, as if the flower had gone to sleep. But when darkness has passed, it opens its eye once more to the full light of day. Because of this it was called by its very fanciful name of the "day's eye," or daisy.

3. The white petals spread out all round the yellow eye or disc like the rays of a star. Each white part, and each tiny yellow part too, is really a separate little flower or floret. The whole of them are held together in a green cup at the top of a slender stem.



THE ENGLISH DAISY.



4. When daisy time comes, the happy children delight to sit in the sunny fields and deck each other with wreaths of these pretty flowers. While sitting in the sweet-smelling grass, one of them will sometimes pluck a white clock to tell the time

of day. Holding it in front of two rosy lips, and counting at each puff, "One o'clock" — puff — "Two o'clock" — puff — "Three o'clock" — puff; and so on, the fluffy white ball is blown away bit by bit to tell the time.

5. The white clock is nothing more than a dandelion gone to seed. Each puff has scattered a number of the seeds, and they are soon carried away on the wind; for the seeds of the dandelion are feathered with fairy wings of what is called white "pappus."

6. When men make a journey through the air in a balloon, they are thought to be wonderful travelers. Yet thousands of seeds travel through the air, wafted upon the breezes when once one strong puff has given them a start as did the little child who was pretending to tell the time with a dandelion clock.

7. The dandelion, whose name means "teeth of



THE FIELD DAISY.

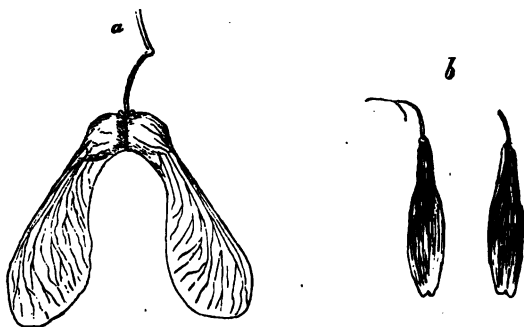
the lion," so called because of its pointed flower leaves, is, like the daisy, a composite flower; that is, it is composed of florets, as are the sunflower, all the thistles, the asters and many other flowers.

8. When a hive becomes too full, some of the bees swarm away to find a fresh home; when a



country gets so full of people that wages become scarce and food becomes dear, some of its sons and daughters go across the seas to live happier lives in new countries. Seeds of plants often have feathery wings given to them, to enable them to scatter themselves abroad and grow on fresh ground where

there is more room ; rather than stay at home and rob their mother plant of nourishment.



a. SEED OF MAPLE. b. ASH.

9. Some of the winged seeds belong to trees. The “keys” of the *ash* and of the *maple* are simply their seeds with bits of skin to them to act as wings or sails. These are not the only ways in which seeds travel and scatter themselves.

10. Some seeds are shot out of their ripe seed-pods with sudden force, like an arrow from a bow.



BURSTING OF WITCH-HAZEL PODS.

Strolling along the margin of the wood, on an autumn day, we may hear a number of pops and crackles going on all around us; these sounds are caused by the bursting of the witch-hazel pods, which shoot their seeds out upon the ground.

LESSON 36.

ROOTS.

PART 1.

ox'-y-gen	fur'-rows	per-haps'	dis-solved'
par'-ti-cles	ma-nure'	branch'-es	sub'-stan-ces
gas'-es	nour'-ish-ing	far'-ther	sur'-face

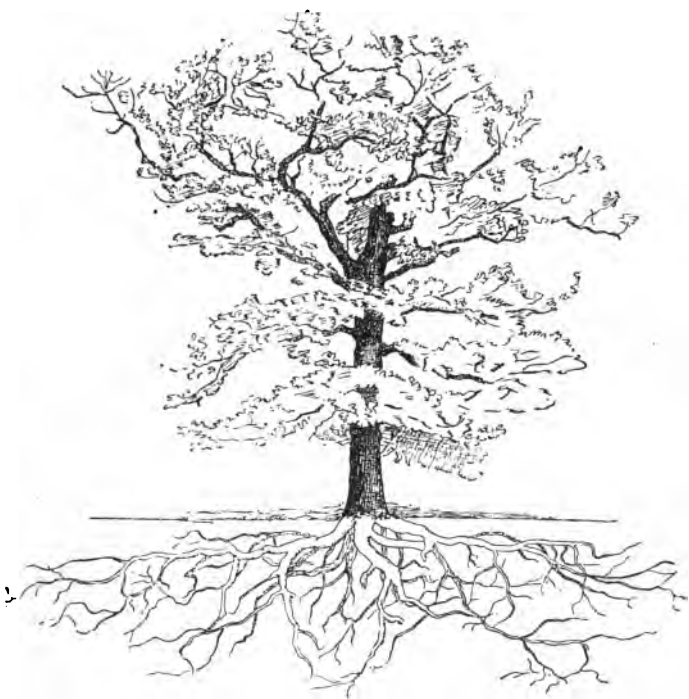
1. Perhaps the most important part of a plant is its root. First of all, the root holds the plant firmly in the ground. The wider the branches of a plant extend above, the farther its roots spread beneath the surface. The roots enable a plant to stand against the shocks of storms.

2. Plants have no power to move about; therefore the food they require must be placed near them. All that a plant requires is found in the air and in the soil; the leaves obtain nourishment from the air, and the roots get it out of the soil. In this way the gases of the air and the fluids of the earth are turned into solid herbage.

3. The chief work of a root is to carry food to the plant; although a plant may obtain some of

its nourishment from the air, it gets much more from the ground.

4. The ends of the roots are like little mouths extending through the soil in their search for food.



AN OAK TREE, SHOWING ROOTS.

A root, however, cannot take in any substances from the soil so long as those substances remain solid; it can only suck up substances that have been dissolved.

5. From this it will be seen how necessary water is to the life of a plant. Ordinary soil consists of small particles of mineral substances, such as chalk, iron and flint, as well as of bits of vegetable matter — dead leaves, rotten wood, and so on. There must be water to dissolve this plant food before the roots can take it in.

6. When the roots of a great tree spread out very wide, as they must do in their search for such large quantities of food, so also do the branches of the tree extend; and thus the rain which drops from the ends of these great spreading branches falls right on to the place where the hungry root-lets are waiting below to feed the tree.

7. Stagnant water in the soil is really harmful to the plants. Farmers therefore drain off surplus water, by putting in drain pipes, or by digging furrows and ditches across their fields.

8. It might be thought that the roots of plants take out of the earth so much of its nourishing substances, that the soil must become poorer and poorer, till at last the plants die simply because there is nothing left for them to feed upon. To provide against this, the air, the rain, and the sun are constantly acting on the earth, in such a way as to cause changes which really keep adding to these nourishing substances.

9. Still, if a farmer wishes to grow a large

supply of food in a short space of time, he puts manure on his land, which enriches the soil, and so enables him to raise better crops. In order to keep a plant healthy its roots must absorb oxygen, a gas which is always plentiful in the open air. It is for this reason that gardeners dig and rake their beds; for by so doing the air is let in between the particles of soil, and thus reaches the roots.

LESSON 37.

ROOTS.

PART 2.

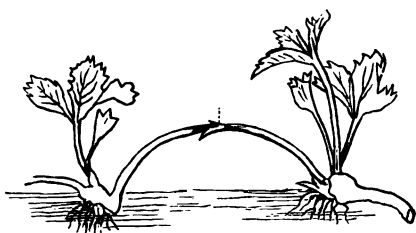
ob-tains'	on'-ion	couch	twitch
del'-i-cate	de-struc'-tion	ac'-id	cel'-lar
ac-quired'	suf-flc'-ient	fl'-brous	shrunk'-en
ta'-per-ing	bi-en'-ni-al	per-en'-ni-al	rhu'-barb

1. There are some substances in the soil which will not dissolve in water, but will dissolve in acid. Now the sap of plants is generally acid, and some of it passing down through the roots into the soil changes the mineral food into such a form that it can be sucked up through the roots.

2. Every bit of the food which a plant obtains from the earth has to pass through tiny roots called root-hairs. These, which are the real feeders, are very thin delicate threads. Therefore the food

must be split up into the very smallest particles, before it can pass through these tiny root-hairs into the root.

3. There are many kinds of roots. Some plants have walking roots, as the strawberry, or as we might call it the "strayberry," and the house-



RUNNER OF STRAWBERRY.

leek; and some have creeping roots, as the twitch or couch grass, whose underground stems are the farmer's pest, and which he often fails to get rid of

even when he plows them up.

4. The habit of extending by underground stems has been acquired by the plant to protect it from destruction; for rabbits and other gnawing animals like to nibble the lower parts of plants and trees, but they never follow the stem after it enters into the soil.

5. The rootlets of the daisy and all grass plants grow in a cluster, like a number of strong threads or fibers. A carrot has a long, thick, tapering root, and its life history is very different. Its seeds grow into plants, but no flowers appear upon them during the first year. At the approach of the cold season the stem dies down; but the root,

protected by the soil, lives on through the winter. In spring it sends up new stems, which, in season, bear flowers and fruit.

6. The taproot, as it is called, having now done its work, dies. A plant that lives only for one year has no need to store up food in a taproot, and therefore has fibrous roots like the grass. When we cultivate the carrot or the turnip for food



DIAGRAM OF A
TAPROOT.



ROOT OF THE
CARROT.



ROOT OF THE
RADISH.

we take care to pull it during the first year while it is plump and has all its goodness still within it.

7. If a sound, dry onion be placed in a damp cellar, we may note how soon it changes its form and condition there. It begins to sprout; it feels soft, and looks shrunk. Leaves grow out at the top, but they are of a much paler green than those which would grow outside in a garden where

there is plenty of light ; at the same time a large number of long, stringy rootlets grow out from the bottom of the onion.

8. What has made the onion sprout? It is simply that the bulb has obtained from the damp air of the cellar sufficient moisture to start it growing. It is no longer a sound, dry onion ; it now feels smaller, softer, and is much shrunk, because the new leaves and roots that have sprouted out have all been fed upon the stored-up food which was contained within the bulb.

9. Flowering plants are divided into three great classes — annuals, biennials and perennials. Annuals are those which live only one year ; as they require no storehouse of food they all have fibrous roots. Biennials are those which do not flower until the second year, and in most cases die after their seed has ripened ; these, like the carrot and the turnip, have large taproots. Perennials are those which live and flower year after year for a number of years.

10. Many roots are used by man. Some are used for food, such as the radish and the parsnip ; some for medicine, such as arrowroot and Turkey rhubarb (which latter is grown in China). Ginger is a root ; beet root furnishes sugar ; and many indeed are the uses to which the roots of plants are put.

LESSON 38.

HIAWATHA SAILING.

wrap'-per	pa'-tience	smeared	tam'-a-rack
sol'-i-tar-y	rust'-led	res'-in	whis'-pered
pli'-ant	ooz'-ing	crev'-ice	ca-noe'
tas'-sels	a-sun'-der	re-sis'-tance	shiv'-ered
fis'-sure	sum'-mit	state'-ly	som'-ber

“Give me of your bark, O Birch-tree!
Of your yellow bark, O Birch-tree!
Growing by the rushing river,
Tall and stately in the valley!
I a light canoe will build me,
Build a swift Cheemaun for sailing,
That shall float upon the river,
Like a yellow leaf in Autumn,
Like a yellow water-lily!

“Lay aside your cloak, O Birch-tree!
Lay aside your white-skin wrapper,
For the Summer-time is coming,
And the sun is warm in heaven,
And you need no white-skin wrapper!”

Thus aloud cried Hiawatha

- In the solitary forest,
When the birds were singing gayly,
In the Moon of Leaves were singing.

And the tree with all its branches
Rustled in the breeze of morning,
Saying with a sigh of patience,
“Take my cloak, O Hiawatha!”

With his knife the tree he girdled;
Just beneath its lowest branches;
Just above the roots, he cut it,
Till the sap came oozing outward;
Down the trunk, from top to bottom,
Sheer he cleft the bark asunder,
With a wooden wedge he raised it,
Stripped it from the trunk unbroken.

“Give me of your boughs, O Cedar!
Of your strong and pliant branches,
My canoe to make more steady,
Make more strong and firm beneath me!”

Through the summit of the Cedar
Went a sound, a cry of horror,
Went a murmur of resistance;
But it whispered, bending downward,
“Take my boughs, O Hiawatha!”

Down he hewed the boughs of cedar,
Shaped them straightway to a framework,
Like two bows he formed and shaped them,
Like two bended bows together.

“Give me of your roots, O Tamarack!
Of your fibrous roots, O Larch-tree!
My canoe to bind together,

So to bind the ends together
That the water may not enter,
That the river may not wet me ! ”

And the Larch, with all its fibers,
Shivered in the air of morning
Touched his forehead with its tassels,
Said, with one long sigh of sorrow,
“ Take them all, O Hiawatha ! ”

From the earth he tore the fibers,
Tore the tough roots of the Larch-tree,
Closely sewed the bark together,
Bound it closely to the framework.

“ Give me of your balm, O Fir-tree !
Of your balsam and your resin,
So to close the seams together
That the water may not enter,
That the river may not wet me ! ”

And the Fir-tree, tall and somber,
Sobbed through all its robes of darkness,
Rattled like a shore with pebbles,
Answered wailing, answered weeping,
“ Take my balm, O Hiawatha ! ”

And he took the tears of balsam,
Took the resin of the Fir-tree,
Smeared therewith each seam and fissure,
Made each crevice safe from water.

HENRY WADSWORTH LONGFELLOW.
(*By permission.*)

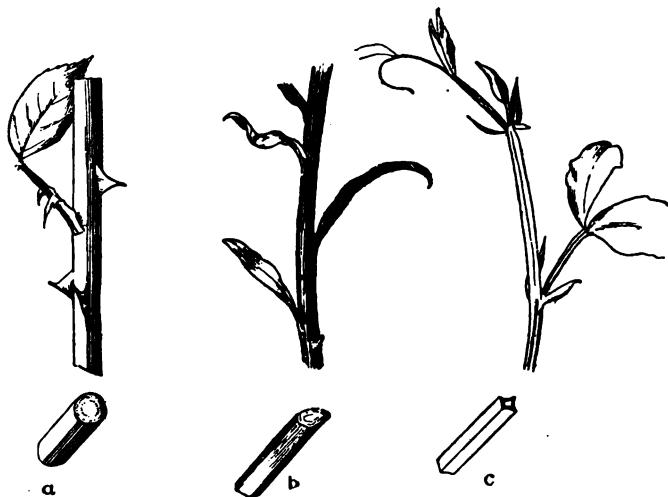
LESSON 39.

STEMS OF PLANTS.

PART 1.

mi-gnon-ette'	sap'-ling	ma-te'-ri-al	tough'-er
her-ba'-ceous	kid'-ney	ab-sorbed'	ad-van'-ces
par-tic'-u-lar	sup-port'	con-veyed'	bram'-bles

1. The stem is that part of a plant which rises above ground from the root ; it carries, in proper season, the buds, leaves, flowers and fruit.



STEMS OF (a) ROSE, (b) WALLFLOWER, (c) SWEET PEA.
(Showing sections of stems.)

2. Stems of plants vary in form ; some are round, some have corners, and some are flat. To

see these three different shapes you have only to cut across the stems of a rose, a wallflower and a sweet pea.

3. Stems differ in other ways also. For instance, the stem of a mignonette is soft to the touch, green in color, pulpy, and easily broken. On the other hand, the stem of a young oak is hard, dark in color, and feels drier than the mignonette, while the fibers are so much tougher that it is not so easily broken as the green stem.

4. All stems like that of the mignonette may be called herblike, or, as the proper word is, herbaceous; while those similar to the oak are spoken of as woody stems. Sometimes on one and the same tree may be seen both tough, woody stems and tender, green shoots which are truly herbaceous; but if these green shoots do not die during the winter they become woody the following season.

5. When a twig of freshly cut willow, or of an ash plant, or of any other woody stem, is stripped of its bark, the part that is left feels sticky. This sticky substance is called the sap, and is really the earth food which has been absorbed by the root-hairs, and is being carried upwards to the leaves. A young tree is often spoken of as a sapling. By means of the stem, other substances are conveyed downwards from the leaves to the root.

6. Yet another duty of the stem is to support

the whole plant ; it is therefore of stronger and tougher material than the branches and leaves which it has to carry and lift above the ground into the air. To do their work properly the leaves need holding in a particular position ; the stem and its branches do this for them, besides carrying the flowers and the seeds of the plant as the season advances.

7. A great tree with wide-spreading branches needs a stem thick and stout, in order to withstand the pressure of high winds, and to support its weight of leaves in summer, or the mass of snow which may weigh upon it in winter. Annuals need only soft and tender stems, because at the end of the season they wither and die away.

8. Some stems, like those of the kidney bean and the hop plant, climb upwards by twining their stems around supports. Ivy stems send out rootlets which will fasten themselves on to walls or wood, or anything else upon which they can manage to cling. The pea will cling to any object it can reach by means of its stringy stems called tendrils. Brambles climb by the help of those hooked thorns which grow along their stems.

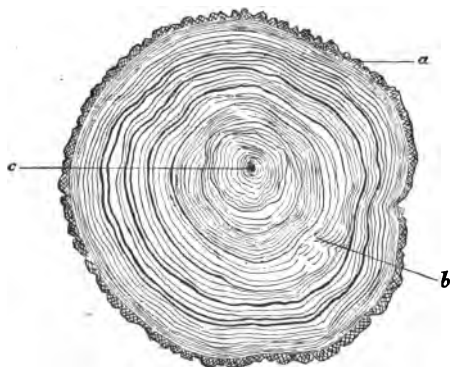
LESSON 40.

STEMS OF PLANTS.

PART 2.

nec'-es-sa-ry	dri'-est	di-rec'-tions	bam'-boo
gut-ta-per'-cha	peeled	de-fen'-sive	juic'-es
in-di-a rub'-ber	de-gree'	clim'-ates	res'-ins
ma-hog'-an-y	tur'-pen-tine	op'-pos-ite	elm

1. Woody stems, such as tree trunks, are made up of pith, wood and bark. The pith is found in the center of the stem. It is the soft substance



SECTION ACROSS TRUNK OF OAK, SHOWING (a) BARK; (b) RINGS;
(c) PITH, OR HEARTWOOD.

necessary for the growth of the young plant, but in the old tree it is no longer needed. In the oak and other large trees it is a mere thread.

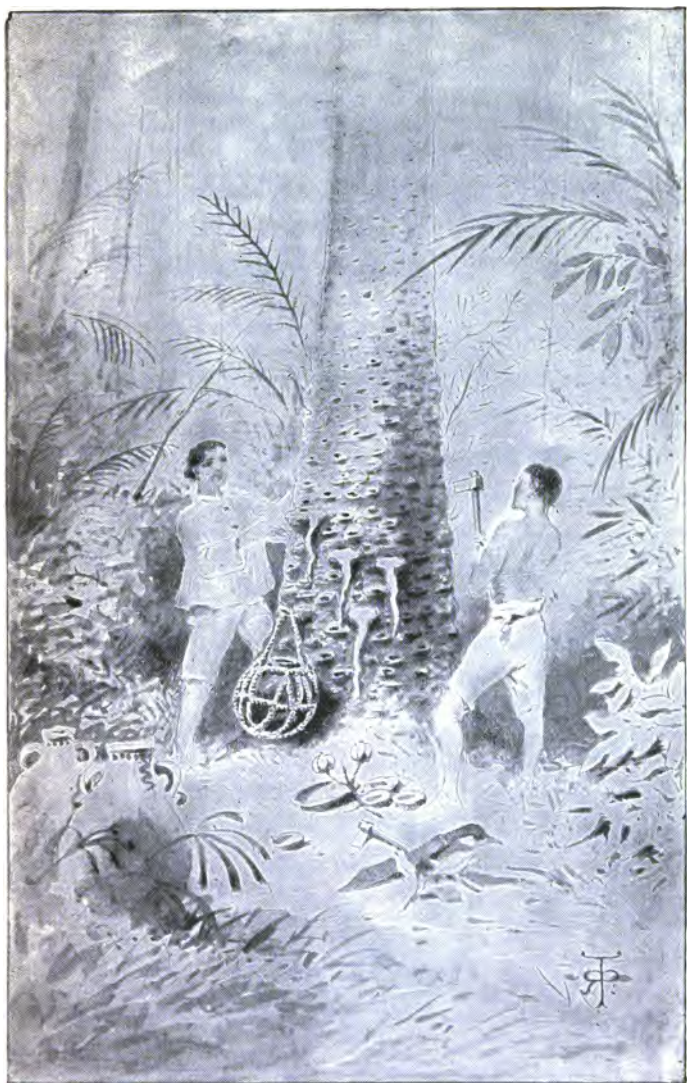
2. If the trunk or stem of a tree, such as the oak or the fir, be sawn across, a number of rings will be seen in the woody part. Each of these rings shows one year's growth of the tree, so that the age of the tree may be found by counting the rings.

3. The hardest part of the woody stem is that nearest the pith, because it is the oldest and the driest: carpenters call it the heartwood. The softer layers outside are known as sapwood.

4. The bark of a tree is its outside layer; but the bark itself has an inner skin called bast, which is so stringy that gardeners split it into strips for tying up their plants. Between the bark and the white wood is a sticky layer; this is the part of the stem which is growing, and some of it will harden into wood fibers, some into bast fibers.

5. In the case of many trees the inside growth goes on until the bark can bear the strain no longer. It cracks in all directions and peels off. All trees which grow from seeds containing two seed-leaves shed their bark, and a renewal takes place where the old has peeled off.

6. The work of the bark is to keep the tree always at the same degree of warmth, for if the tree is to keep alive, its sap must pass freely along both in the heat of summer and in the depth of winter—it must never dry up or freeze. Bark



NATIVES GETTING JUICE FROM INDIA-RUBBER TREE.

serves as a defensive armor, too, against such enemies of the tree as the woodpecker and the gnawing rabbit. Oak bark is made useful in tanning leather. Cork is but the bark of an oak which grows in Spain.

7. Canes and bamboos have no bark; but the hardest wood in them is on the outside. These plants are nothing more than giant grasses, and like the common grass they grow from seeds which contain one seed leaf.

8. Some trees contain juices which run out, and then dry solid in the form of gums and resins. Gutta-percha is the juice of a tall tree that grows in Asia, and india rubber is another dried, milky juice of certain trees which grow in warm climates. Turpentine is obtained from pine trees.

9. Among hardwood timbers the oak is one of the best. The walnut, chestnut, beech and ash are also valuable timber trees. Pine, hemlock and cedar are the most valuable evergreens. Mahogany is a fine timber from tropical America.



LESSON 41.

THE SPECIAL WORK OF LEAVES.

PART 1.

fo'-li-age	re-fresh'-ing	poi'-son-ous	car-bon'-ic
earth'-ing	man-u-fac'-tures	stretched	va'-por
blanched	con-tin'-ued	hor-i-zon'-tal	cel'-er-y

1. How refreshing and pleasant a tree looks in a wealth of beautiful green foliage. But why does a tree need this covering of green leaves?

2. Plants and trees breathe by means of their leaves. The part of the air taken in by the leaves is a poisonous gas which men and animals breathe out; the other part, which is useful to animals, is breathed out by the leaves. Thus one part of the air helps to feed plants, and the other part to feed animals.

3. Or, put into proper words, this is what happens: plants give out oxygen, and take in carbonic acid gas. All the green parts of a plant have the power, if it becomes necessary, to eat carbonic acid gas; but this work is done very much better by the leaves. Leaves are the eating organs of the plant; they are both mouth and stomach. They assist the flow of the sap, and

convert carbonic acid and water into the starch which feeds and builds up the plant.

4. The nourishing life blood of an animal is forced through the body by the action of its heart ; a plant has no such pumping organ to force along the flow of its sap. The sap is first absorbed into root-hairs and rootlets till their sides are stretched to the full ; this water cannot flow back in them, but by their elastic walls it is pressed upwards. At the upper end of the tree — that is, where the leaves are — the water in the cells is turned into vapor by the warmth of the sun ; or, as we say, it is evaporated. An empty cell at the top then allows the water to flow into it from the next one below ; and so the upward movement of the sap is continued and assisted.

5. It may be noticed that a lot of moisture will sometimes collect upon the inside of a glass shade such as is kept upon a window to cover growing plants. This moisture has been drawn out of the pores or tiny breathing holes of the leaves by the action of the sunlight. It is the sunlight, too, which manufactures the starch, and which makes the green coloring of the plant. Plants grown in the dark become white ; celery is blanched, or made white, by earthing it up so as to hide its stalks from the sunlight.

6. In order to get as much sunlight as possible,

leaves hang in a horizontal position ; for the same reason, the lower branches grow out wider than upper ones. Leaves are always shaped in such a fashion as to get as much sunlight upon them as possible. Plants kept in the dark soon die.

LESSON 42.

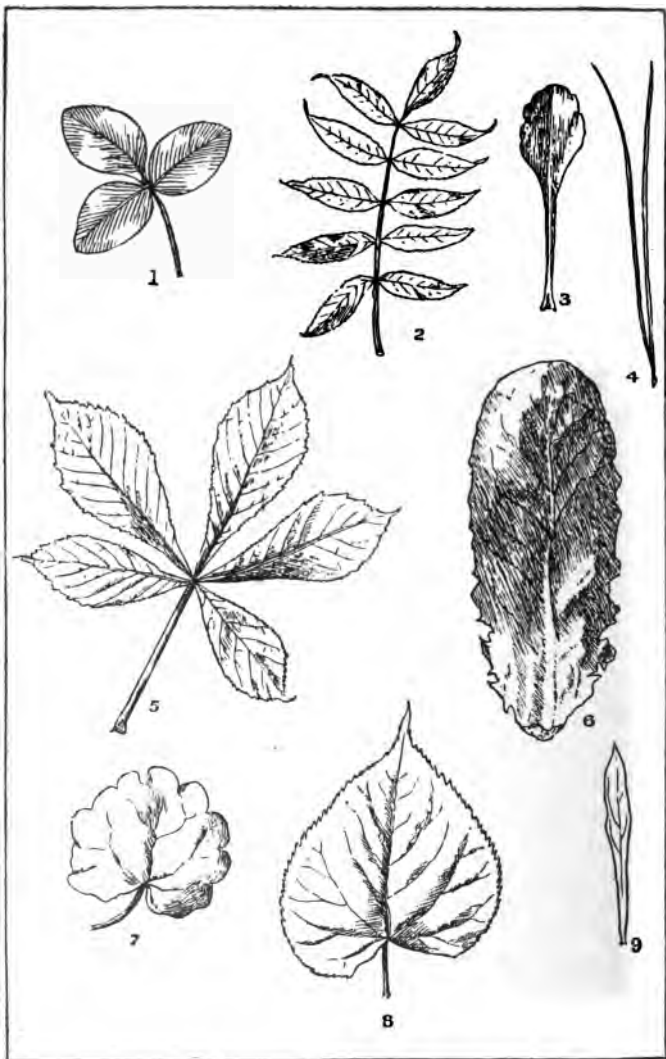
THE SPECIAL WORK OF LEAVES.

PART 2.

va-ri'-et-y	chest'-nut	let'-tuce	veins
e-vap-o-ra'-tion	grate'-ful	en'-e-mies	cot'-ton-y
de-coc'-tions	pur'-i-fy-ing	bev'-er-age	nee'-dle
pe'-ri-od	de-cid'-u-ous	or'-din-a-ry	shin'-y

1. Considerable variety may be found in the shapes of leaves. Some are lance shaped, like those of a wallflower ; spoon shaped, as the English daisy ; needle shaped, as the Scotch fir ; heart shaped, as the lime, or linden ; kidney shaped, as the ground ivy ; and so on.

2. Very large trees often have very small leaves ; or else they have compound leaves — that is, large leaves divided up into parts to allow them to catch as much of the sunlight as possible ; for instance, the leaves of the ash are divided featherwise, and those of the horse-chestnut are



LEAVES: 1. LEAF OF CLOVER. 2. LEAF OF ASH TREE. 3. LEAF OF ENGLISH DAISY. 4. LEAF OF FIR TREE. 5. LEAF OF HORSE-CHESTNUT TREE. 6. LEAF OF LETTUCE. 7. LEAF OF GROUND-IVY. 8. LEAF OF THE LINDEN OR LIME TREE. 9. LEAF OF WALLFLOWER.

parted like the fingers on a hand. Clover is a small plant which has compound leaves; the lettuce is one which bears a simple leaf all in one piece.

3. The veins in a leaf act as our veins do—they form the small pipes along which may flow the nourishing life fluid. In some leaves the veins run up all parallel with the center one, as in the grasses; some leaves have branching veins, and in some the veins are like network.

4. On their surfaces leaves also differ very much. The elm leaf has a hairy surface; the foxglove leaf has a downy surface; the coltsfoot leaf a cottony surface; the oak leaf is uneven or rough to the touch; and some leaves have a hairy upper surface with a downy under surface.

5. All these are protections to the leaf against its enemies; insects feed on the fleshy parts of leaves, and the hairs are intended to hinder the



SKELETON OF LEAVES TO SHOW
(a) BRANCHING VEINS; (b) VEINS
PARALLEL TO CENTER.

little creepers. Some large herb-eating animals refuse leaves that are rough with hairs. Hairs, too, assist to pass off any wet which may lodge upon the leaf and so hinder its work of evaporation.

6. Again, some leaves have a smooth edge, like those of the clover and the wallflower; while others have a rough sawlike margin, the notches of which vary very much in shape, as in the oak and the dandelion.



LEAF OF
DANDELION.

7. Leaves provide a grateful shade and a shelter, for man and beast and bird. Some leaves are eaten for food, as those of lettuce and cabbage; while the leaves of the tea plant are made into a refreshing beverage.

8. Many are the leaves of the green herbs — or simples, as they were once called — from which medicines are made for the purifying of the blood and the healing of disease. As to the grass of the fields which grows everywhere around us, it is the ordinary food of horses and cows and sheep, and many smaller animals besides.

9. Plants are divided into two classes: those whose leaves die and fall off in the autumn of each year; and those whose leaves remain on till new

ones have grown to take their places. The first class are called deciduous, which means "falling"; and the second class are known as evergreens.

10. Deciduous trees have a period of rest; but evergreens carry on their manufacture of starch all the year round. Evergreens (as may be noticed in holly, ivy and box) possess a shiny surface, and always wear a hardy appearance, as though they were made to face the cold blasts of winter.

LESSON 43.

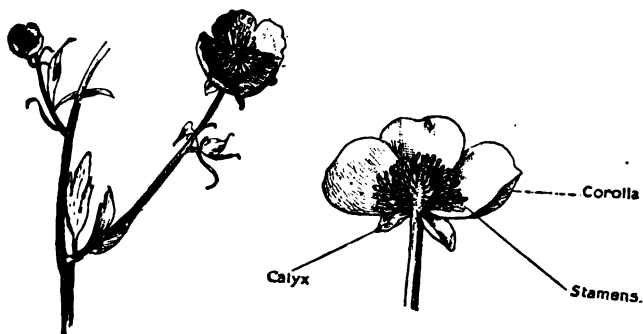
A FLOWER'S MISSION.

ex-pos'-ure	se'-pal	cor-ol'-la	en-tice'
ca'-lyx	pet'-al	en'-trance	de-vic'-es
con'-se-quent-ly	sta'-mens	pis'-til	mix'-ture
fer-til-i-za'-tion	stig'-ma	dur'-ing	cū'-cum-ber

1. A flower consists of four parts. The outer part, which surrounds all the others, and serves as a protection to them until they are strong enough to bear exposure to the air, is called the *calyx*, a Greek word which means a "cup." Each cup-leaf is called a sepal.

2. Next comes the colored part of the flower, an inner ring which is called the *corolla*, a Latin name for "a little crown." Each crown leaf is called a petal. Petals have great variety of color; some possess a perfume, and some are without it.

3. As the work of the calyx was to protect, that of the corolla is to attract. Many flowers require the presence of insects to assist them in their work. The object of the flower is, therefore, to entice within it the particular insect whose presence is needful. This it does by storing up within its body sacs or tiny bags of nectar. An enticing odor and this delicious, honeyed food are sufficiently attractive to secure the "busy bee's" service.



A BUTTERCUP, SHOWING CALYX, COROLLA, STAMENS.

4. When a flower is plucked, an insect may often be found within its cup. At the same time there may be noticed hairs and other devices inside it, which are intended as a protection against the entrance of the wrong sort of insect, which would be but a useless robber of the honey, and would render no assistance whatever to the flower. Among the insects most useful to plant life in this respect are bees, butterflies, wasps and moths.

5. Inside the corolla there will be seen some little colored spikes or stalks. These are called stamens. Each spikelet or stamen has a head, called an anther, which contains colored dust or pollen. When ripe the anther bursts open and scatters the pollen.



AN EASTER LILY, SHOWING STAMENS, PISTIL AND ANTHERS.

6. Then there is the pistil or seed-vessel, which is the most important part of the flower, for it remains and grows after all the other parts have died away. It is, in fact, a seed-chamber, but containing seeds that are at first unripe ones.

7. These seeds in the pistil would never ripen,

or come to anything, unless the pollen from the stamen of its own or some similar flower had fallen upon it. The pollen of a buttercup, for instance, would be quite useless to the pistil of a dandelion.

8. But if the right pollen falls upon it, as it does when its stamens are placed above the pistil, it is caught on the sticky head of the pistil, called the stigma; and then a wonderful thing takes place. At the foot of the pistil there is a seed-egg which this pollen mixture runs into and makes fertile; or, in other words, makes it begin to live. It now becomes a real seed and begins to get larger, and to ripen into the fruit of the plant.

9. Those flowers in which the stamens are above the pistil, and which consequently enable the pollen to fall down upon the stigma of the pistil, are said to be self-fertilizing. In other cases, where the stamens are placed below the stigma, so that the falling pollen could never reach the sticky head of the pistil, the flowers would never become productive unless the pollen were carried up to the stigma in some way. Here it is that the assistance of insects is required to bring about what is known as cross fertilization.

10. How does the flower contrive to attract the attention of insects to help it in this work? It hangs out a sign, just as a tradesman does to

attract customers. This sign is its flaunting color. But at night-time color cannot be seen by those insects which are of night-flying habits. They are therefore attracted by perfume, as is the case with the sweet-smelling honeysuckle.

11. The daisy, on the other hand, closes up during the darkness, for it does not require visits from insects of the night-flying kind.

12. All flowers do not contain both stamens and pistil; the cucumber, for instance, has one stem producing flowers with stamens, and another producing flowers with pistils. Insects become useful if not necessary in these; for they daub themselves with the pollen dust of one flower, and carry it on their bodies to the stigma of another; and in this way do they make the plant become fruitful.

13. Truly the ways of Nature are very wonderful in matters that are seemingly so small. An insect buzzing from flower to flower is a circumstance we scarcely notice; and yet it means that the creature is seeking food to sustain its own life, and at the same time is fertilizing plants in order that they may grow and replenish the earth.

14. Grasses and plants that bear colorless flowers do not depend upon insects for their fertilization; it is the wind that sways them about and scatters their pollen in such a way that some of it

will be sure to come in contact with the stigmas. And thus do the grasses of the field live and thrive merely by waving in a summer breeze.

LESSON 44.

FLOWERLESS PLANTS.

fierce'-ly	vag'-a-bond	un-roll'	swad'-dling
fern'-er-y	to'-tal-ly	ridg'-es	borne
brack'-en	o-ver-lap'	grace'-ful	par'-ent

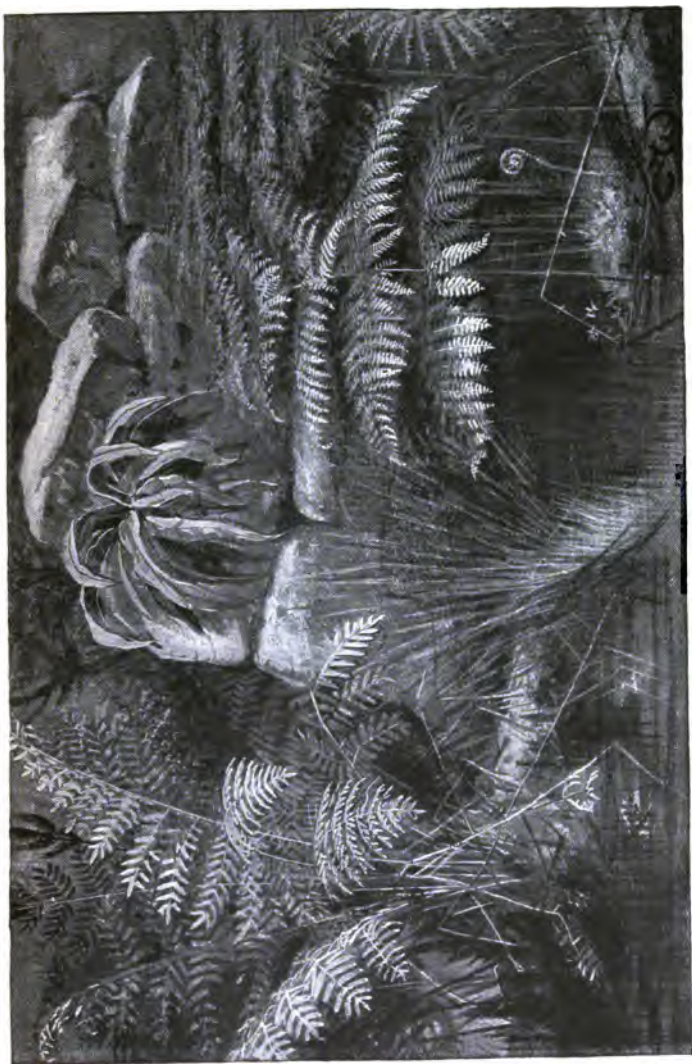
1. How refreshing it is on a hot summer day to rest for a while in some cool, shady spot, especially after a long walk in the glare of the sun.

2. The long green grass, the trickling water of the little wayside stream, and the rustling of the leaves on the trees, all help to rest and soothe one.

3. The tall trees stretch out their arms overhead to protect us from the fierce rays of the noonday sun. A carpet of cool grass is laid ready for our feet.

4. On one side, the bank seems to be upheld by the trunks of the trees ; but on the other side, the high sandy bank has been deeply burrowed by the busy rabbits. Dead leaves are strewn about, and lacy ferns spring from every crevice in the rocks.

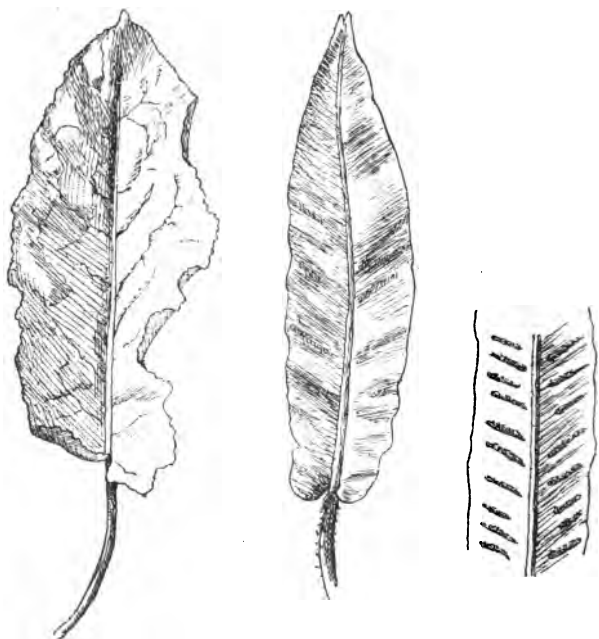
5. A little farther along, where the road begins to climb the hill, is an old stone wall on which we



SOME FERNS.

shall perhaps find the curious hart's tongue fern, with its strap-shaped fronds, growing in the joints of the damp masonry.

6. How different in appearance is this fern from the frail maidenhair ferns we have just passed, or



A DOCK LEAF.

FROND OF FERN.

FROND OF FERN,
SHOWING SPORES.

from the hardy bracken we can see over in the woods yonder. So widely does the hart's tongue differ from the other ferns, that we are half inclined to doubt that it is a fern; it seems to bear

more relation to the vagabond dock we see on every bit of waste land we pass.

7. If you pluck a dock leaf and a frond of this fern, and compare the two, the difference between them soon becomes quite clear.

8. On the back of a frond are a number of rusty-colored ridges. These alone are enough to tell us that the fern belongs to the order of flowerless plants. As to the dock, it boasts a tall spike of ruddy flowers; do not its companions flaunt themselves on every side of us?

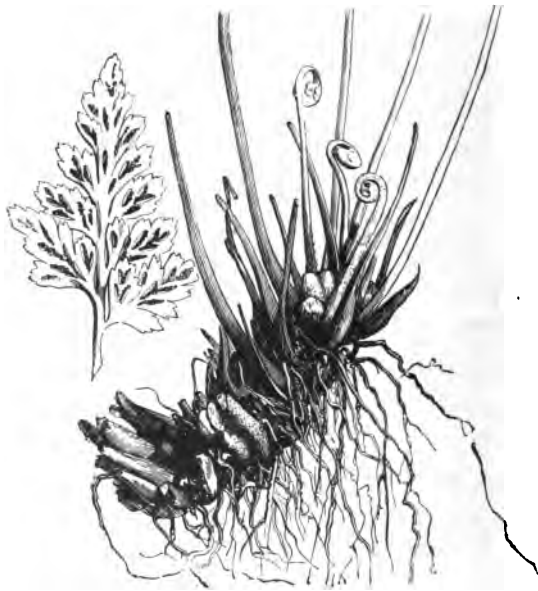
9. The rusty ridges on the back of the frond are spore-cases. When ripe and very dry, they will be split open by a springy ring which will stretch itself out straight, and send the spores flying. Spores are not seeds, but much simpler things that take the place of seeds.

10. So small and light are they that, when the scattering takes place, many of them will be borne away on the wind to a distance, some falling where they will be wasted, and some on places that will exactly suit them.

11. A spore that alights on a moist shady bank, or on a stone kept damp by the splashing of a little spring, has found a very likely spot to suit it. For in due time plantlets, in the shape of tiny green scales which overlap each other, will be found on that moist surface. These heart-shaped scales have

very fine hair-like rootlets, but they are in nowise like the graceful parent fern from which they sprang.

12. Here, then, may be noted the difference between a seed and a spore. A seed gives rise directly to a plant exactly like the parent plant ;



A FERN ROOT, AND FROND SHOWING SPORES.

a spore produces something which is totally unlike the parent.

13. The green scale may afterwards grow into a fern if all goes well with it, but it will take a year or two to arrive at its full size.

14. Much of a fern's early growth takes place underground. The fronds of the common bracken, for instance, are snugly packed in a little roll. Beginning at the base of the leaf, these fronds slip one by one from their cosy beds. Baby fronds are they, as the swaddling meshes of fern-wool plainly declare.

15. Their roots will for a long time be creeping under stones and wood, ever feeling their way in the direction of moisture. Not perhaps till the warm showers of the third summer will those graceful fronds unroll themselves, to form their circlet of tall green plumes.

16. What is more beautiful in form than the fronds of a fern? Could any flower add unto its beauty one jot? It is surely beautiful enough in itself!

LESSON 45.

THE KINDLY FRUITS OF THE EARTH.

ma-tu'-ri-ty	cult-ti-va'-tion	grad'-u-al-ly	or-ig'-in-al
cush'-ion	cand'-ied	fu'-ture	cir'-cle
re-vert'-ed	cur'-rants	fronds	spores
hor'-ti-cul-ture	rai'-sins	spe'-cies	sur'-plus

1. On the place where the flower has been, there the fruit of the plant will afterwards make its appearance. As the blossom fades away, the

fruit begins to show itself. The fruit is the pistil grown to maturity; sometimes the calyx or flower-cup remains attached, as it does to the apple and the gooseberry.

2. The fruit is nothing more than a case to contain the seeds. These seed-cases ripen into a variety of forms. Some become what is commonly known as fruits, some become berries, some pods, and some grains.

3. In the apple, the seeds are inclosed in a mass of hard pulp which is such good eating; the pips or seeds are covered by the tough scales of the core or center, as a further protection. To this class of fruit, which includes the apple, the pear and the hip of the rose, is given the name of *pome*.

4. A ripe apple is juicy. A ripe plum is even more so; the pulp is quite soft, but the one seed in its center is protected by being incased in a hard stone which it is difficult to crack. This kind of fruit is called a *drupe*. A blackberry is said to be made up of drupels or little drupes.

5. In a third class of fruits, which are also juicy, and to which belong the gooseberry, the orange, and the grape, the seeds are merely embedded within the pulp. The name of *berry* is given to this class.

6. Some fruits when ripe are not juicy at all, but are quite dry. Peas and beans, for instance,

have their seeds fastened to little stalks, and inclosed within a case which is called a *pod*.

7. Grains, also, as wheat and barley, oats and rice, are the fruit of the plant, ripened exceedingly dry.

8. There are many exceptions to these common forms of fruit. In the strawberry, which is really not a berry at all, nor yet a drupe, nor a pome, the seeds actually grow outside on the surface, and the soft juicy pulp forms a sort of cushion for them to lie upon.

9. Horticulture, as we call the cultivating of gardens, has altered the nature of many fruits. When a particular kind of fruit, as the apple or pear, has been improved by high cultivation, slips are cut from the plant, and grafted on to strong, well-grown stocks of inferior fruit trees; and in this way the finest kinds are produced and kept up.

10. All the fine kinds of apples have arisen from one parent kind; namely, the crab-apple. They can only be produced by careful cultivation in good soil and by grafting; and if the seeds of the finest variety were sown in ordinarily poor soil, the quality of the apple would gradually grow worse till the fruit reverted again to the original crab.

11. The work of the fruit is to disperse the seeds within it. The devices by which it does

this are various. Sometimes the seeds are scattered by bursting pods, sometimes they have attached to them feathery or hairy wings by which they float away upon the wind; and sometimes the fruit merely falls and rolls along the ground, carrying the seeds in its interior; as the gooseberry, the apple, the cherry and the peach do.

12. We began this set of lessons on plant life with a parent seed; we have seen how that seed may sprout, grow up, blossom forth, and in its turn bear other seeds to carry on the species in a never ending circle of life.

13. But plants bear very many more seeds than are necessary for sowing in the ground to carry on their species. These surplus seeds are not always wasted. Seeds such as corn, beans and barley, as well as many fruits, such as apples and pears, afford a pleasant food for man. Not only are they eaten when fresh, but often they are prepared for future eating. Plums are dried into prunes, and grapes into currants or raisins. Some are candied with sugar, and some are made into jam and preserves.

14. Flowerless plants, which have only simple spores in place of seeds, bear no fruits. Thus ferns bear no flowers; they produce leafy fronds, which bear cases or bags in which the spores are

found. The brown dust of ferns consists of the spores which in these lower plants serve the purposes of seeds.

LESSON 46.

THE FLAX FLOWER.

thrive
a-stir'

be-fall'
breeze

pleas'-ant
scarce

seem'-eth
good'-ly

1. Oh, the little flax flower !
 It groweth on a hill,
 And be the breeze awake or 'sleep
 It never standeth still ;
 It groweth, and it groweth fast ;
 One day it is a seed,
 And then a little grassy blade
 Scarce better than a weed ;
 But then out comes the flax flower,
 As blue as is the sky ;
 And " 'Tis a dainty little thing,"
 We say as we go by.
2. Ah ! 'tis a goodly little thing ;
 It groweth for the poor,
 And many a peasant blesses it
 Beside his cottage door.
 He thinketh how those slender stems
 That shimmer in the sun,

Are rich for him in web and woof,
And shortly shall be spun.
He thinketh how those slender flowers
Of seed will yield him store ;
And sees in thought his next year's crop
Blue shining round his door.

3. Oh, the little flax flower !
The mother then says she,
“Go, pull the thyme, the heath, the fern,
But let the flax flower be !
It groweth for the children's sake,
It groweth for our own ;
There are flowers enough upon the hill,
But leave the flax alone !
The farmer hath his fields of wheat,
Much cometh to his share ;
We have this little plot of flax,
That we have tilled with care.”

4. Oh, the goodly flax flower !
It groweth on the hill,
And be the breeze awake or 'sleep
It never standeth still ;
It seemeth all astir with life
As if it loved to thrive,
As if it had a merry heart
Within its stem alive.

Then fair befall the flax field,
And may the kindly showers
Give strength unto its shining stem,
Give seed unto its flowers.

MARY HOWITT.

LESSON 47.

BREADSTUFFS AND NATIONAL FOODS.

in'-flu-ence	knot'-ted	pre-ferred'	maize
dai'-ly	ce'-re-als	quan'-ti-ties	or'-ang-es
tap-i-o'-ca	por'-ridge	des'-erts	in-fer'-i-or
hard'-i-er	sour'-ish	sa'-go	wrap'-ping

1. The same food would not suit all nations, because different degrees of heat and cold have such an influence on the human body, as to make different kinds of food necessary in different parts of the earth.

2. In most countries in temperate climates the staple food is wheaten bread. A wheat field when the young plant is first springing up looks much like a field of grass. Wheat has a fibrous root and blade-like leaves, but the hollow knotted stem grows much taller than that of ordinary grass. On the top of each stem is an ear, which at first is a green flower, and afterwards the full fruit or grain.

3. The hard dry grains are threshed to get away the husks or chaff surrounding them; the grain



RICE.

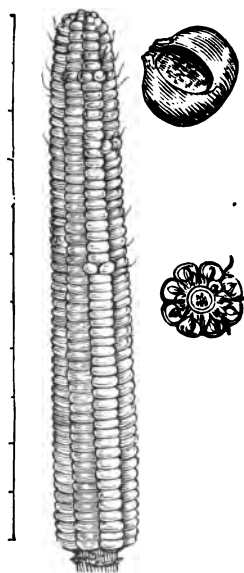
then being ground in a mill, the inner white portion yields flour, and the outer coat bran. The stems are useful as straw.

4. In some far Eastern countries the "staff of life" is not wheaten bread, but rice. The rice plant is a species of grass, whose grains grow in clusters very much like our graceful dancing oats. As the plant grows best in very moist soils, low-lying lands subject to floods are preferred for its cultivation. Rice fields are called paddy fields. The rice is generally rubbed between flat stones instead of being threshed to remove its yellow husks. Rice forms the staple food of the people of India, China and Japan. It contains little fat, and is easily digested, but the people have to eat large quantities of it.

5. When the Pilgrims came to America the Indians taught them how to cultivate Indian corn or maize. They found it a most strengthening



MAIZE, OR INDIAN CORN.



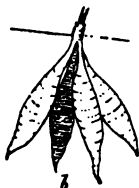
AN EAR OF MAIZE, A CROSS-SECTION OF THE EAR, AND A KERNEL OF THE FULL SIZE.

food. There are many varieties of corn: fodder corn grows the largest; sweet corn is cultivated

for table use ; while the pop-corn is a favorite with the children.

6. Maize or Indian corn belongs to the grass family. The leaves are long and narrow. The flower is in two parts. The tassel which nods at the top and scatters its pollen so freely is one part.

The other part is the fine silken hair seen at the end of the ear. Each tiny thread comes from a kernel in the ear. The ear is incased in a leafy sheath. Cornstalks are fed to cattle with most beneficial results.



THE MANDIOC PLANT, SHOWING
(a) A BRANCH ; (b) THE ROOT.

7. In Turkey, and in the neighboring countries where the people live similar lives to the Turks, a grain called millet or durra is largely used as a breadstuff. It is

a small grain which makes a useful bread for hot countries, but in this country it is used to feed cattle and poultry.

8. By breadstuffs we usually mean only those grain fruits called cereals, which are largely used in the feeding of various nations. But we must

fitly consider here other kinds of food stuffs besides cereal foods.

9. In South America the root of the mandioc plant is largely used. This root is poisonous until it has been prepared with fire to drive out the poison. When still more carefully prepared it comes into this country as tapioca, a good, starchy food from which puddings are made.

10. In the islands of the far East a similar food is extensively made from the starchy pith of a beautiful, tall palm tree; it is called sago. All these starch foods are useful to the human body as heat-givers, or force-producers.

11. In Scotland it is found that a grain much hardier than wheat must be grown, in order to ripen there. The oat is therefore largely grown, and may be reckoned the national food of the Scotch, who eat it as oat-cake, and oat-meal porridge.

12. Black bread is a favorite food in the northern parts of Europe. It is made from rye flour, is dark colored, heavy and sourish. It keeps moist for a long time.

13. Wheaten bread is the whitest and the sweetest. In olden England the people were glad to eat blencorn — that is, wheat blended with large quantities of inferior grain. In Ireland one of the chief foods is the potato; in the deserts of Africa dates,

pressed into a kind of cake, form almost the only food carried by travelers there.

LESSON 48.

PLANTS WOVEN INTO FABRICS.

dye'-ing	bolts	es'-sen-ces	ne'-groes
ex-am'-ple	ex-tract'-ed	ma-chine'	ca-nal'
in'-di-go	fab'-ric	heck'-led	pulp'-y
col'-lars	bleach'-ing	ca'-bles	varn'-ish-es

1. Not only do plants furnish food, but they provide clothing and many other materials useful in daily life.

2. Mention has been made of the oils, gums and medicines obtained from plants. In the manufactures, plants and their products are very largely used. Plants are used in dyeing; for example, the hard logwood of Central America makes a red dye, while indigo, from India, produces a blue dye. Oak bark aids in the tanning of hides into leather. From the flowers of the rose, the violet and the lavender, and from many other highly scented plants, oils and essences are extracted for the making of perfumes.

3. The important textile manufactures, as we call the making of woven goods, include not only those in which the raw materials are produced from animals—as wool and silk; but those in

which vegetable produce is the raw material — as cotton, flax, hemp and jute.

4. Cotton is used for clothing more than any other material. It comes from a plant which grows about the size of a currant bush and bears a yellow flower. The flower is succeeded by a pod which bursts open when ripe. The soft, white, cottony down which surrounds the seeds then puffs out.

5. A cotton plantation is quite as pretty when white all over with these bolls, as when it is in full flower. Cotton will only grow in the hot parts of the earth; as our Southern states, India, Egypt and Brazil. Negroes can stand the heat better than other people, so they are mostly employed on the plantations in America. They pick the cotton, and after the seeds have been removed from it by a machine called a cotton gin, they pack it into bales.

6. These bales of raw cotton are sent to the cotton factories of the North as well as those of the cotton-growing states. Large quantities are exported to European countries to be worked up there. Many thousands of men, women and children find employment in the cotton factories of England. The cotton fibers are twisted into threads; the threads are put into looms and woven into various fabrics, such as calicoes, muslins and prints.

7. In our country also grows another plant that is used to manufacture a most useful fabric. It is more largely cultivated in Ireland and in Holland, where its manufacture is very extensive. This is the flax plant, from which linen is made.

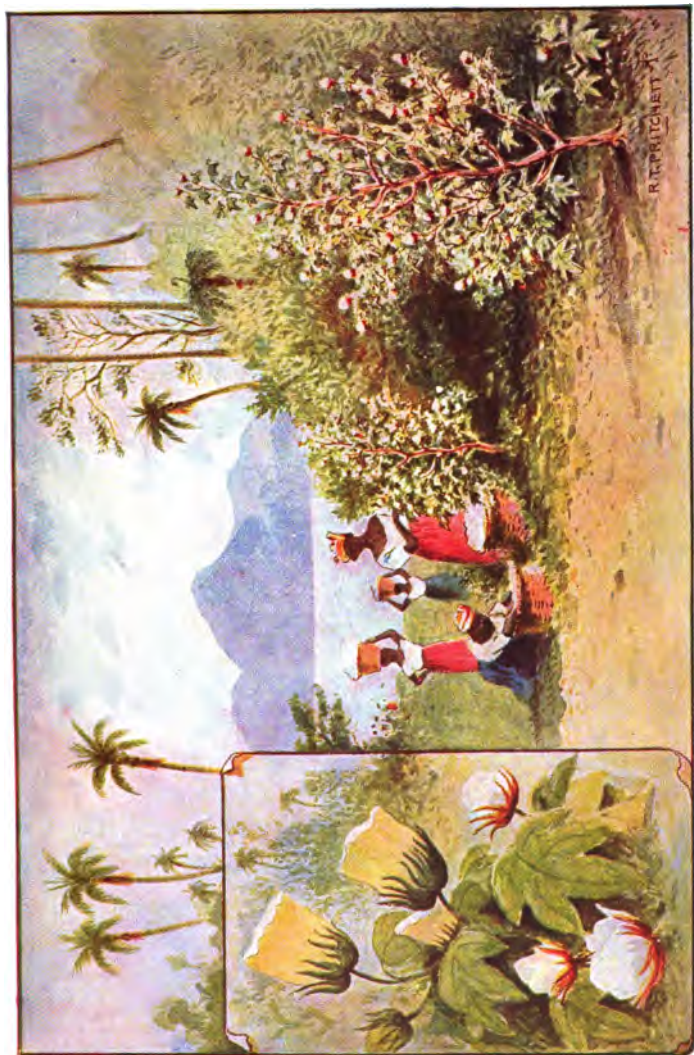


THE FLAX PLANT.

8. Flax is a slender, pretty, herbaceous annual, and bears a bright blue flower. The flowers are followed by seeds — known to us as linseed. The fibrous stems of the plant are pulled when ripe, and then steeped in water. After being dried they are beaten with mallets, and are then “heckled” by being drawn through a brush of fine steel needles, till the pulpy part is all removed and only the silky fibers are left.

9. The flax is then ready to be spun into threads; the threads are woven into linen and whitened by bleaching. Linen is not only strong but beautifully white and fine; it is cool, smooth, glossy, and more expensive than cotton. It may be of a light or heavy quality. Linen is used for table covers, bed coverings, and for clothing. Much delicate and dainty embroidery is made upon linen.

10. Hemp is another useful plant; it is related



SEA ISLAND COTTON.

to the common nettle. Hemp-seed oil is a useful drying oil, used in paints and varnishes. The cake from which it is pressed makes a good cattle food. The tough bast fibers of hemp are twisted into string, ropes, cables, and all kinds of cordage; its threads are woven into canvas and sailcloth.

11. Jute is the bark of a plant belonging to the same class as the lime or linden tree. Its bast fibers are not unlike those of the common lime, and known as "bass" in the making of door-mats. Jute is more durable than hemp, and is used to make gunny bags (for packing), tarpaulins, backings for floorcloths, and other textiles subjected to hard wear. It is grown largely in India, and manufactured chiefly at Dundee in Scotland, though there are many factories in India.

He prayeth well who loveth well
Both man and bird and beast.
He prayeth best who loveth best
All things both great and small;
For the dear God who loveth us,
He made and loveth all.

SAMUEL TAYLOR COLERIDGE.

SUMMARIES OF LESSONS

AND

NOTES FOR TEACHERS

LESSON 1 (p. 5).—MONKEYS (MANLIKE ANIMALS).

1. The **most manlike** of all the animals is the monkey.
2. Yet **no monkeys** can stand **quite upright**—they have to **live in trees**.
3. Monkeys have no feet, but **four hands**; some use their **tails as hands**.
4. An **ape** has **no tail**; a **baboon** has a **short tail**, and is more doglike in form; real **monkeys** have **long tails**.

LESSON 3 (p. 12).—ELEPHANT (THE LORDLY ELEPHANT).

1. The **elephant** is a **thick-skinned** animal, which in the hot countries of the East is caught, tamed, and made to work as a **beast of burden**.
2. The elephant is the **largest of the quadrupeds**, but becomes quite **docile** and **obedient**.
3. Its most **wonderful feature** is its **trunk**, which it can use as we do our arms and hands.
4. The **eyes** are **small** and the **ears flapping**; the legs are **thick**, but all four can **kneel**.
5. Elephants are **hunted** for their **ivory**.

LESSON 4 (p. 15).—INTERESTING SOLE-WALKERS.

1. **Bears and skunks** are **sole-walkers**; bears are becoming scarce, but skunks are common.

2. A bear can sit up and use its forepaws like hands; its large claws are sharp and movable, enabling him to scratch, dig and climb.

3. The skunk is a dark-coated animal about the size of the cat; it is nocturnal in habit. Its food consists of mice, grubs, caterpillars, grasshoppers, field mice, etc.

LESSON 5 (p. 19).—AMERICAN BEARS.

1. Bears eat a mixed diet. They are therefore classified at the end of the flesh-eaters.

2. Bears get very fat through the summer. This fat sustains them during the period of hibernation. Scarcity of food, not severity of cold, impels them to den up.

3. The fur is thick and shaggy. It is made into rugs, robes and articles of clothing.

4. The grizzly bear of the Rockies is a most dangerous and cunning beast. The black bear is more cowardly. The polar bear differs from other bears in being carnivorous.

5. The term "bruin" means "browncoat." It was first used as a fanciful name for the brown bear of Scotland.

LESSON 6 (p. 23).—ANIMAL AND PLANT LIFE IN AUSTRALIA (TOPSY-TURVYDOM).

1. In Australia many things in nature are found to be contrary to our ideas of them.

2. All the trees are evergreens, and animal life is rather scanty. Most of the useful plants and animals had to be introduced from England.

3. Nearly all the quadrupeds belong to the group of pouched animals; the largest is the kangaroo.

4. The strangest animal is the duckbill (or platypus), a fur-covered mammal which has a beak and lays eggs as birds do.

LESSON 7 (p. 27).—THE KANGAROO.

1. The kangaroo is the **largest animal of Australia**. It is a **pouched animal**.

2. While the **fore legs** are **short**, the **hind legs** are **big and strong**.

3. The kangaroo **sits up to feed** on the tender tops of plants; it generally **moves by taking mighty leaps**.

4. The kangaroo is **hunted** by both **settler and native**; although a gentle creature it will turn and **fight** its enemy with the **strong claws of its powerful hind legs**.

LESSON 9 (p. 31).—THE EAGLE (THE KING OF BIRDS).

1. The **eagle** is a **bird of prey**, and therefore has **beak and talons** strong, curved, and pointed.

2. When the **prey is clutched** it is often killed by the **shock**, or by the talons **piercing its heart**.

3. Eagles live together **in pairs**, their **aerie** being perched on some **high rock** out of the reach of man.

LESSON 10 (p. 33).—THE OWL (A NIGHT BIRD).

1. **Owls** are much like **feathered cats**; they live near houses, **catch mice**, and are made for **night prowling**.

2. They have a **warm covering**, a **noiseless movement**, **keen hearing**, and **eyes** for seeing in the dark.

3. They **hiss and scratch** when angry.

4. Owls **eject little balls** of the food that they cannot digest; a number of these are **used for a nest**.

5. The most common is the **screech owl** and the largest is the **great horned owl**. The **snowy owl** comes from the **cold north**.

LESSON 12 (*p.* 37).—ATTRACTIVE HOMES AND THEIR BUILDERS.

1. Baltimore orioles build chiefly in **elms** and **maples**. The **female bird** is said to do the **weaving**. Both **claws** and **bill** are used as **tools**. The **pendulous nest** is woven with **hempen fibers**, **horsehairs**, **pigs' bristles**, **corda**, **plant down** and **wool**.

2. **Vireos** are **wood birds**. The **pensile nests** may be found upon **shrubs** and **saplings**. They are composed of **leaves**, **tough bark**, **spider silk**, **newspaper**, **snakeskins** and other materials. They are usually **ornamented with cobweb**.

3. Catbirds build in **bushes** or **low cedars** usually. The nest is **rough in structure**, being made of **twigs**, **rags**, **twine**, etc., and carefully lined.

4. The **robins**, **phoebes**, and **barn-swallows** are **masons**. They are **birds** of the **orchard** and **garden**. Robin **destroys** quantities of **worms** and **grubs**, while the **phoebe** and **barn-swallow** **free the air** of **noxious insects**. The nest of the **phoebe** is an acquisition for the cabinet.

5. The **bank-swallow's nest** is a **feather-lined tunnel** in a sandy cliff. It serves as both nest and resting-place for these energetic voyagers. The chimney-swift's nest is a **crescent-shaped** arrangement of **twigs** **glued** together with tree-gum or the bird's saliva.

LESSON 13 (*p.* 42).—BY THE WATERSIDE — PART 1.

1. The **swan** belongs to the **goose family**.

2. The swan is a **graceful swimmer**, but is somewhat awkward on land.

3. Like the goose, the swan **hisses** when angry, and **defends** itself with its **wings**.

4. Its **feathers** are **white**, its **bill** **red**, and its **legs** **black**.

5. It **builds its own nest**; the hen lays six or seven eggs; a young swan is called a **cygnet**.

LESSON 14 (p. 44).—BY THE WATERSIDE—PART 2.

1. Turtles are **amphibians**. They **live** chiefly upon **flies** and other **insects**.

2. The marsh wren builds a **nest of grass** and **fastens** it to **flags** or **cattails** in marshy places. The nest and mode of anchorage resemble that of the field mouse's snuggery among the grains and grasses. This wren's bill is very long. Its movements are nervous and jerky.

3. The **red-winged blackbird** builds on **low bushes** in marshy places. Its note is **liquid** but **not melodious**.

4. The **yellow warbler**, or summer yellow bird, **wears a dress entirely yellow** save a few streaks on the breast. Its note is not so musical as that of the goldfinch, with which it is frequently confused, though the goldfinch is a larger bird and has a black crown and much black upon its wings.

5. **Dragon-flies** lay their **eggs** upon **aquatic plants**. The **nymph stage** is passed in the **water**, where it **feeds** upon **smaller animals**. Dragon-flies **emerge** on **calm days**. In rough weather an attempt to come to the surface ends in drowning.

LESSON 15 (p. 45).—SNAKES.

1. Snakes are hatched **from eggs** (except **vipers**).

2. **Some** snakes have **poison fangs**, as the deadly rattle-snake and copperhead.

3. Serpents have **no limbs**, and **yet** are most **active**.

4. They **swallow their food alive**; the victim is **seized from behind**, and must then disappear down the throat, for, the snake's teeth pointing backwards, **the swallowing must be completed**.

LESSON 16 (p. 48).—VENOMOUS AND NON-VENOMOUS REPTILES.

1. The rattlesnake and copperhead are both **venomous reptiles**. They **live** usually in **rocky and mountainous places**, but in times of **drought** they **come to the plains and meadows for water**.

2. **The black snake, garter snake, blowing adder, green snake, and all other American species are harmless.**

3. Snakes are **scavengers**, feeding upon rats, mice, moles, cutworms, grubs, etc. Their work is **beneficial to the farmer**.

4. Snakes pass the winter in a **state of torpidity**.

LESSON 17 (p. 51).—BUTTERFLIES AND MOTHS
(FOND MOTHERS AND UGLY BABIES).

1. **All insects go through several changes** before they become perfect: first, the **egg**; secondly, the **grub or larva**; thirdly, the **pupa or "baby"**; and lastly, the **insect or imago**.

2. **A butterfly lays her eggs on the leaves she knows her grubs will like best to eat.**

3. As **caterpillars eat so ravenously**, the **eggs** have to be **scattered over a wide space**; this is why the butterfly has **wings to fly so far**.

4. **Caterpillars devour so much, and grow so fast**, that they have to change **their skins** several times.

5. When the **eating is over** the creature **hides away** for a long time; the **pupa or "baby-form"** of a butterfly is called a *chrysalis* (*chrysos*—gold).

6. **A moth has no knobs** on its feelers; its **body is heavier** than that of a butterfly; it is usually **darker in color** because it **comes out at night**.

LESSON 18 (p. 55).—INSECT MIMICRY
(AN INSECT'S DISGUISE).

1. **Helpless** creatures, such as insects, often **preserve themselves** from destruction by **pretending to be lifeless objects**.

2. The **caddis-worm** makes a **case** of **any material** with which it may be **surrounded**.

3. The **caddis-case** has a **float** of wood, so that it can **move on the surface** of the water, as well as **at the bottom**, or wherever the creature needs to go in search of food.

LESSON 19 (p. 59).—ANIMAL MIMICRY
(HIDE AND SEEK).

1. Moths and butterflies often **partake of the coloring** of the **surrounding scenery**.

2. **Pale-colored moths** on a **dark-colored soil** are **easily discovered** by their enemies, and soon **disappear** by becoming **an easy prey**.

3. Some moths **escape their foes** by appearing to be **nothing more than a scar** on the bark of a tree; or they will hang from a branch and appear like a dead leaf.

4. Many of the **smaller and more defenseless creatures** are only preserved by **assuming the appearance of inanimate objects**.

5. **Some creatures** are **similarly disguised** so that they may creep unnoticed upon unsuspecting prey.

LESSON 20 (p. 64).—SPIDER
(THE LITTLE SPINNER AND WEAVER).

1. The spider is **not an insect**; it has **eight legs**, and does **not pass** through several **life stages** to become perfect.

2. Spiders **prey on insects**, and are **useful in a garden**.

3. They **spin and weave** their webs from a **fluid** which comes from their **spinnerets**. Upon coming to the air this **fluid hardens** and a **thread is formed**.

LESSON 21 (*p.* 67).—COBWEBS.

1. Spiders **foretell the weather**, as they never make or mend their webs when bad weather is at hand.

2. The **framework** of the web **is made first**; the **spiral thread** is put round afterwards.

LESSON 23 (*p.* 71).—THE LOBSTER

(CREATURES WITHOUT BACK-BONES).

1. Some animals have **no back-bones**; as the **jointed animals**, the **soft-bodied animals**, and the **rayed animals**.

2. Among the jointed animals is the **lobster**, which has **walking legs** and **swimming legs**, but the greatest power is in its **tail**.

3. The lobster **grows** by a **succession of moults**, one in each year, until full size is reached.

4. The lobster is **bluish-black**, but turns red when boiled for food.

LESSON 24 (*p.* 75).—CRABS.

1. **Crabs** have **jointed shells**, which they **cast off** and re-new every year.

2. They are **ten-legged** creatures. Their **head and chest** are all in one.

3. The crab is a **sea scavenger**; sometimes it plays cannibal, for it will kill and eat a neighbor crab.

4. **Fishermen** catch crabs in **baited pots** or basket traps.

5. The small **hermit crab** has a **soft tail**, which he **protects** in the **shells** of periwinkles or whelks.

LESSON 25 (p. 80).—PEARL MAKERS—PART 1.

1. The oyster is a **soft-bodied animal** ; it has **no limbs**, and after the **embryo** stage **no** power of locomotion ; the body is protected by **two shells**. The **oyster** is a **bivalve**.

2. Each **shell** is **lined with** a coat of smooth substance called **mother-of-pearl** or **nacre** ; the outside of the shell is very rough.

3. The **beard** of the **oyster**, as the dark edges are called, is the **gills** or **breathing organ**.

4. Oysters feed on **tiny living creatures**, and **vegetable matter**.

LESSON 26 (p. 83).—PEARL MAKERS—PART 2.

1. Oysters are hatched from **eggs** or **spat** cast by the parent upon the water. Young oysters fasten to **weeds** and **stones**. When a **year old**, **oystermen** take them up and **replant** them in **beds** especially prepared.

2. Young oysters are very **delicate**, have **numerous enemies**, and **perish in great numbers**.

3. **Pearl oysters** inhabit **warm waters** ; they are **sought** for the **nacre** that lines their shells, as well as for the **gems**.

4. An **irritating parasite** or **grain of sand** entering the shell of the oyster **is covered** with the **nacreous matter** in order to relieve the sufferer, and in due time becomes a pearl.

5. **Pearl fisheries** are carried on off the coasts of **Australia**, **Ceylon**, and **China**. Some **beautiful** and **valuable pearls** have come from the **Gulfs** of **Mexico** and **California**.

LESSON 27 (p. 89).—THE SCALE OF ANIMAL LIFE.

This Table presents a general view of a simplified Classification:—

THE ANIMAL KINGDOM.

SUB-KINGDOM OR DIVISION I.

Back-boned Animals, which have a skull and an internal skeleton, held together by a vertebral column or back-bone.

Class 1. — Mammals or Sucklers, warm-blooded, and more or less covered with hair (as Man, the Quadrupeds, Whales).

Class 2. — Birds, warm-blooded, hatched from eggs, and covered with feathers.

Class 3. — Reptiles or creeping creatures, cold-blooded, produced from eggs, breathe by lungs, and sometimes covered by plates or scales (as Snakes, Crocodiles).

Class 4. — Double-lived Creatures, living both on land and in water—cold-blooded, breathe by gills when young and by lungs when mature (as Frogs and Toads).

Class 5. — Fishes, cold-blooded, breathe by gills.

SUB-KINGDOM OR DIVISION II.

The back-boneless creatures have a nervous system which is distributed in knots all over the body; they hardly ever have red blood.

A. Jointed Animals —

1. **Worms**, with bodies ringed, without limbs, or very simple limbs that are not jointed.
2. **Centipedes** have many pairs of legs, a separate head but no distinct regions; never winged.
3. **Crusted Animals** that are water-breathers, such as Crabs and Lobsters.

4. **Spiders**, unwinged, having four pairs of legs, and two regions, the head being joined to the chest.
5. **Insects**, having divided bodies (head, chest and belly), and three pairs of legs. These are arranged in Orders, according to the number and form of the wings.

B. Soft-bodied Animals —

Bodies are not jointed, and are more or less protected by hard shells.

Group 1. With a **distinct head**. Class 1 are head-footed (Cuttle-fish); Class 2 are belly-footed (Snail).

Group 2. Headless (Oyster).

C. Rayed Animals —

Lowest forms of life, as these creatures have few organs, and are of simple structure (as Starfishes, Jellyfishes, and Sea Anemones).

LESSON 28 (p. 92).—SEA ANEMONES

(PLANTLIKE ANIMALS—PART 1).

1. Its parts or organs are a **body**, a **mouth** and **tentacles**.
2. The **base** acts like a **sucker** to attach the creature to the rock.
3. The **tentacles** move about as **feelers**, and seize the **prey**; the victim is **drawn into the mouth**, from which **undigested portions** are afterwards **ejected**.

LESSON 29 (p. 95).—SEA ANEMONES

(PLANTLIKE ANIMALS—PART 2).

1. If an Anemone be **cut into two parts**, each part will grow and **reproduce what it has lost**.

2. The **beadlet** is the **commonest species**: so called because of its rows of blue beads.

3. The **green opelet** has 180 long, rounded tentacles; can inflate itself and **swim to the surface**.

4. The **gold-spangled anemone** has golden spots on a pea-green coat.

5. The **parasitic anemone** is drab, and likes to live on a shell-fish. (*Parasite* means one that lives upon another: many animals and plants are parasites.)

LESSONS 30 AND 31 (pp. 96 and 101).—CORAL PRODUCERS
AND ORNAMENTAL CORALS.

1. Coral polyps are **closely allied** to the **sea anemones**. Sea anemones have **power to change** their position, **corals have not**.

2. Both sea anemones and corals **belong to the plant-like animals**.

3. Coral polyps, through **simple organic functions**, build coral substances.

4. They secrete **carbonate of lime**, which with **silica** and **sand** composes coral.

5. They are **builders of reefs** and **island foundations**, as well as many **fancy structures**.

6. They live in **extensive colonies** and their lives are **interdependent with each other**.

7. They are the inhabitants of **warm and pure sea-water**.

8. Red coral is the **most valuable** of the corals, being **used in the manufacture** of various **trinkets**.

9. **Coral fisheries** are **carried on chiefly by the Italians** off the coast of Tunis and Algeria.

LESSON 32 (p. 105).—PLANT LIFE.

1. A **plant**, like an animal, **has organs**; a mineral has no organs, and is therefore said to be inorganic.

2. **Plants**, like animals, **live, feed, grow** and **die**.

3. **Some** of its **organs** *feed* the plant, and *some* are concerned in the **work** of **producing its seeds**.

4. There are **two great classes** of plants: there are **flowering plants**, which produce **seeds**, and there are **flowerless plants**, which only produce **spores**.

LESSON 33 (p. 108).—SEEDS.

1. Seeds require **warmth, moisture and air** to make them **grow**.

2. There are **two great classes** of seeds: those which have **one seed lobe**, and those which have **two**.

3. **A bean** has two seed lobes, which make up the **bulk** of the **seed** and contain a supply of **food** for the **baby plant**.

4. A **grain** of **wheat** has one seed lobe, but it contains in itself a **store** of **starchy food** for the **young plant**.

5. Seeds are intended to **continue the species**, but **man** **uses** them for many purposes of his own.

LESSON 35 (p. 115).—SEEDS WITH WINGS

(DAISY TIME AND DANDELION CLOCKS).

1. The **daisy** has **white petals** round a **yellow disk**.

2. The flower is really a **cluster of florets**—**white** ones on the **crown**, and **yellow** ones on the **disk**.

3. **Dandelions** go to seed early in the season; **each seed** has a number of **white hairs** (pappus), light enough to **float** it through the air.

4. Seeds often **scatter and spread** by means of pappus.

5. **Some** seeds are **scattered** by being **shot** out of their dried-up cases. This is the case with **violet** and **witch-hazel** seeds.

LESSON 36 (p. 120).—ROOTS—PART 1.

1. Roots **support the plant**, and **convey food** to it.

2. As the **branches** of a plant **extend**, so do its **roots spread**.

3. A plant can **only absorb food** which has been **dissolved**; hence the necessity of **water** to plant life.

4. **Stagnant water** is **harmful** to the roots of plants; **farmers** therefore **drain their land** of surplus water.

5. To prevent the **soil** from becoming **exhausted**, the action of the **weather** **causes such changes** as keep up the **supply of plant food**.

6. **Cultivators**, however, add **manure** to supply what their growing crops take out of the land.

LESSON 37 (*p.* 123).—ROOTS—PART 2.

1. Roots have near their lowest end **root-hairs**, which are the **real feeders**.

2. There are **many kinds of roots**: among them the **walking root** (as of the strawberry, which strays along the surface), and the **creeping root** (as of the couch grass which creeps underneath the surface, and spreads till it can scarcely be gotten rid of).

3. **Flowering plants** are divided into **Annuals**, **Biennials** and **Perennials**.

4. **Annuals** have **fibrous roots** and live only for **one year**.

5. **Biennials** do not **flower** till the **second year**; they have **large taproots**, which serve as stores of **winter food** to sustain the plant till its second year.

6. **Perennials** flower **year after year**. **Trees** and shrubs have **fibrous roots**; they are **thick, woody and outspreading**.

LESSON 39 (*p.* 130).—STEMS OF PLANTS—PART 1.

1. **The work** of a stem is to **carry the plant** and lift it above the ground; and to **convey the sap** from the roots to the leaves, etc.

2. Stems are **round, or angular, or flat**.

3. Stems **twine**, or they **cling** by **rootlets**, or by **tendrils**, or by **hooked thorns**.

4. Some stems are **herbaceous**, and some are **woody**.

LESSON 40 (p. 133).—STEMS OF PLANTS—PART 2.

1. The **age of a tree** can be told by **counting the rings** in its wood.

2. **Heartwood** is the harder part in the **center** (thus the phrase "hearts of oak"), and the **sapwood** is the softer **outside layers**.

3. The **bark** protects the tree, and **keeps the sap at the same temperature**.

4. Some trees yield **gum and resin** when a cut is made in their stems. India rubber, gutta-percha and turpentine are gotten in this way.

5. The stems or **trunks of forest trees** yield **timber**.

LESSON 41 (p. 137).—LEAVES—PART 1.

1. Leaves are the **breathing or eating organs** of a plant.

2. They **take in carbonic acid** wherewith to **manufacture the starch-food** which feeds and builds up the plant.

3. **Evaporation** takes place in the leaves, and this **moves the sap upwards**.

4. Leaves do their **work by the aid of sunlight**; sunlight is therefore necessary to the life of a plant. Sunlight **also colors** the plant green.

5. Leaves **grow horizontally** to catch the **sunlight**.

LESSON 42 (p. 139).—LEAVES—PART 2.

1. Leaves have **many shapes**; some are **simple**, and some are **compound**, or divided up into parts.

2. Leaves are **veined in various ways**; the life fluid runs along the veins.

3. The outside or **surface** of a leaf is often rough, or hairy; this is a **protection against enemies**.

4. Some leaves have a **smooth edge**, and some a **notched edge**.

5. Leaves are used as **food**, and **grass** is the ordinary food of **countless creatures**.

LESSON 43 (p. 143).—THE WORK OF A FLOWER
(A FLOWER'S MISSION).

1. The **calyx** is the **outer cup** of the flower: it is divided into **sepals**.

2. The **corolla** is the **colored ring** divided into **petals**.

3. The **stamens** are spikelets topped with **anthers**, which burst when ripe and **scatter pollen** or dust.

4. The **pistil** has a sticky head called the **stigma**, and at its foot has a **chamber of seed-eggs** or **ovules**.

5. The seed-eggs are **never fertile till the pollen mixture** has run down from the stigma.

6. **To bring the fertilizing pollen, insects are often necessary**, and to **attract** the insects to the work, the flower has **bright colors**, or **perfume**, and **nectar**, or "honey."

LESSON 44 (p. 148).—FLOWERLESS PLANTS.

1. **Ferns** belong to the order of **flowerless plants**.

2. **Some plants bear flowers** which are succeeded by **seeds**.

3. A fern has **no seeds**; it has **spores** instead, which may be found underneath the frond, or leaf.

4. A **spore is simpler** than a seed, but from it will grow a plant very **different from the parent plant**. It takes **time** to produce one like the parent plant.

LESSON 45 (p. 153).—FRUITS
(THE KINDLY FRUITS OF THE EARTH).

1. The fruit is the **seed-case** of the plant—some are **berries**, some **Pods**, some **grains**.
2. Fruit with a hard pulp, and seed in cells, is a **pome**, as apple, pear.
3. Fruit with a soft pulp, and one seed in a hard stone, is a **drupe**, as plum and peach.
4. Fruit with soft pulp, and seeds in the pulp, is a **berry**, as currants, gooseberry, orange, lemon and grape.
5. Man **uses surplus fruits**, and by **cultivation** has vastly **improved many**.

LESSON 47 (p. 159).—BREADSTUFFS AND
NATIONAL FOODS.

1. **Different climates** necessitate **different kinds of food**.
2. In this **country wheaten bread** is the staple food.
3. In the populous **countries of the far East**, **rice** is the chief food of the people.
4. In **North America maize** is largely grown—when boiled it is called mush; split maize is called hominy.
5. **Millet**, a small white grain, is used largely as human food in **Turkey** and other **hot countries**.
6. **Oat bread**, **barley bread**, and **rye bread** are used in **colder countries**.
7. **Tapioca** is made from the roots of the **mandioc** or cassava plant, and **sago** from the **pith of a palm**. **Dates** are eaten in the **desert**.

LESSON 48 (p. 164).—PLANTS WOVEN INTO FABRICS.

1. **Cotton** grows in **hot countries**, as the Southern states of America, India, and Egypt.

2. **Raw cotton** is the **downy** covering of the seeds.
3. Cotton is one of the main staples of the United States.
4. **Flax** is grown in America and England, but more largely in **Ireland**, where **linens** of all kinds are made.
5. **Hemp** is made into **cordage and sailcloth**.
6. **Jute** makes the strongest textiles, such as **packing-bags** and **tarpaulin**.

